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The Batcheller System of Pneumatic Tubes.

In our issue of October 14 last we noted the formal opening of the pneumatic tube mail service between the main Post Office and the Produce Exchange branch office of this city. The tubes have been in uninterrupted service since the opening.

We are now able to present illustrations from photographs and working drawings, showing the main features of the plant. This tube is of 8 inches internal diameter, and is the largest yet made. The only other one approaching it in size is the Batcheller 6-inch tube connecting the main and a branch post office in Philadelphia. These two tubes are the only ones in existence which are intended for general mail transportation, the 2½ and 3-inch tubes in use in Europe having a very restricted application.

The enlargement of the diameter of these tubes presents many problems for solution, growing chiefly out of the greatly increased weight of the carriers. With the increased diameter goes an increase of length, while structural strength requires large carriers to be of much more substantial construction than small ones. Again, the weight of the loads carried increases with the size of the carriers, the result being that while the European tube carriers will hold but a few messages and weigh but a few ounces, an 8-inch Batcheller carrier holds from 500 to 700 letters, and weighs, loaded, about 30 pounds. It is clear enough that the stopping of such weights from high velocities cannot be safely done with simple mechanical stops, and that collisions between two carriers, which with small ones would do no damage, might, with such weights, be attended with disastrous consequences. It is mainly on these points that the peculiarities of the system turn, although in the case of this tube another interesting feature lies in the fact that one of the stations is in the middle of the tube system, the carriers at that station being received from, as well as despatched through, a tube which is under pressure.

The power station is located at the Post Office, and the tube ends at this station represent the beginning and end of the pipe system, one end receiving the compressed air from the compressor, while the other is the final discharge, the pressure there being reduced practically to that of the atmosphere. At the Produce Exchange the tube ends are connected together, and are under the same pressure. The compressor thus maintains a constant movement of the air down to the Produce Exchange and back again, this current carrying the carriers with it, the pressure at the compressor end being such as to move air and carriers against the frictional resistances at the required velocity—about 30 miles per hour. The pressure required to do this is about 6 pounds per square inch.

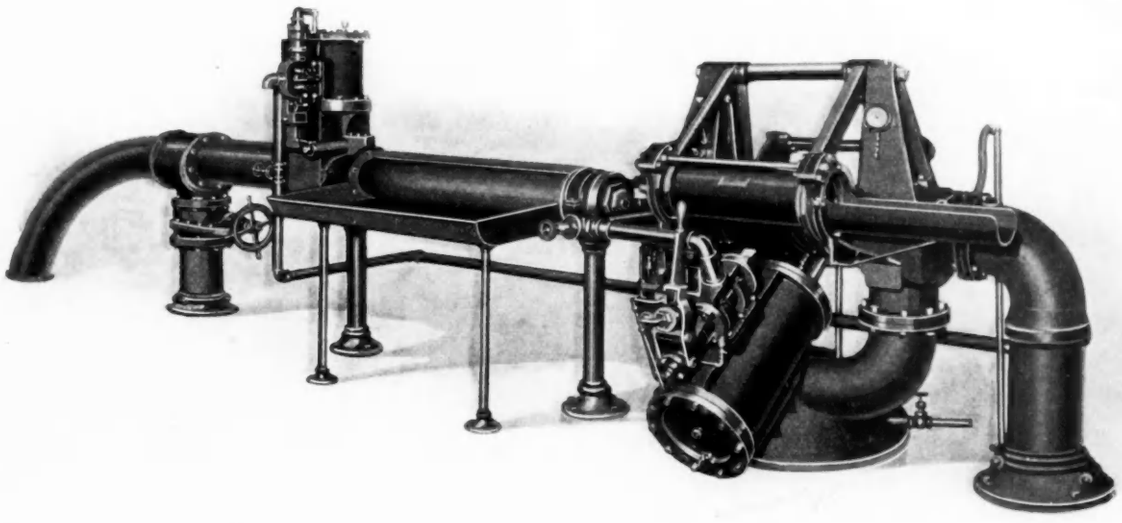

FIG. 1.—MAIN POST OFFICE STATION.

Fig. 1, from a photograph, shows the Post Office station. The pipe from the compressor is seen coming up through the floor at the right, where it connects with the dispatching apparatus, while the broad tray in which the incoming carriers are received, together with the mechanism of the receiving apparatus, is seen at the left. The sending apparatus consists of two short tube sections, mounted on a swinging frame and inserted in the main tube, so that either of the swinging tubes can be brought in line with the main tube, somewhat after the manner of a revolver chamber. This is seen more in detail in cross section in Fig. 2, the two

swinging cylinders being seen at *a* and *b*. the center, about which they swing, being at *c*. At *d* is a power cylinder for effecting the movement, through the hand lever *e*, and the accompanying valve gear. In sending a carrier it is placed in the trough seen at the right in Fig. 1, and is then pushed into the open swinging cylinder. Lever *e* is then operated, when the loaded cylinder swings into place and the carrier is off. A U-shaped by-pass will be seen below the sending apparatus in Fig. 1, and in cross section at *f* in Fig. 2. This by-pass contains an adjustable valve, by which the division of the air passing through it and the swinging cylinder can be adjusted in such manner as to start the carrier gently. An additional feature of the sending apparatus, not fully shown, is a time-lock, by which the pulling of lever *e* will not operate the mechanism until after a certain interval has elapsed since the sending of the previous carrier. This interval is ordinarily adjusted to be eight or ten seconds.

The receiving apparatus at this station is seen in section in Fig. 3. The incoming air and carrier enter at the left, as shown by the arrow *a*. The air is discharged through the lantern casting and passes downward, as shown by arrow *b*, when it re-enters the compressor and is used over and over, this plan being adopted to avoid the accumulation of water in the tube, which would be the result if fresh air were constantly used. The carrier passes on under its momen-

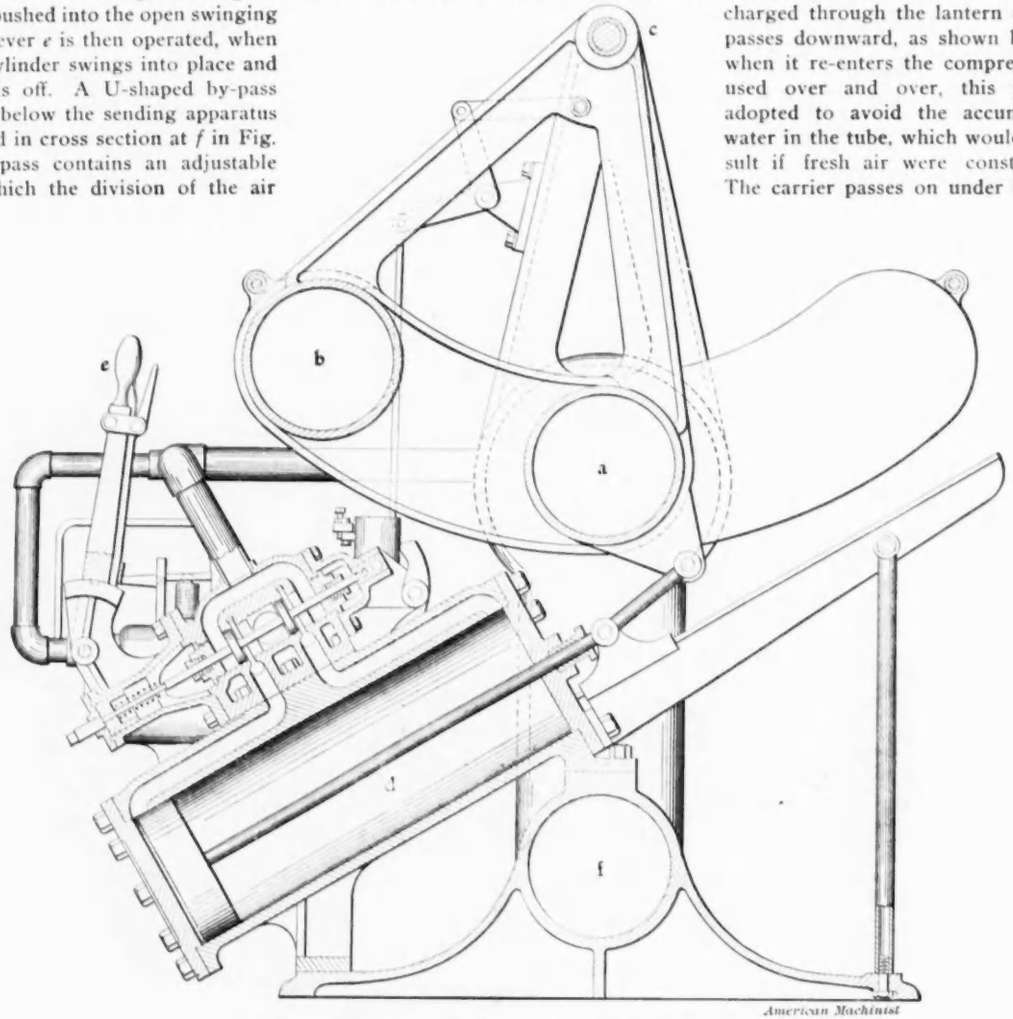

FIG. 2.—SENDING APPARATUS FOR BOTH STATIONS.

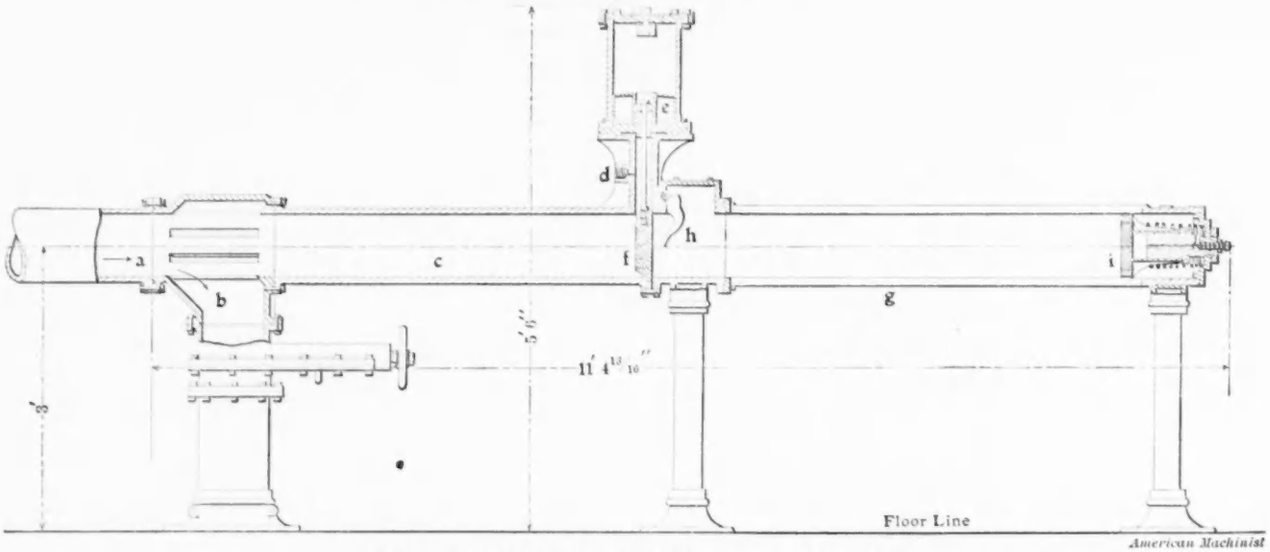

FIG. 3.—MAIN POST OFFICE RECEIVING APPARATUS.

tum into the dead end *c*, where it compresses the air before it, the air cushion destroying most of its velocity. This compressed air, through a pipe connected at *d*, operates a valve which admits air from the main below piston *e*, which raises the gate *f*, and permits the carrier to pass on to the receiving table *g*, better seen in Fig. 1. As the carrier passes out it trips trigger *h*, which reverses the valve controlling piston, *e*, and thus closing the gate. A buffer *i* receives the carrier harmlessly.

The Produce Exchange station will be seen in Fig. 4. The sending apparatus seen in the background does not differ from that already described, except that it is operated from the opposite end to suit convenience. The conditions at the two stations do not differ as regards the sending apparatus, which must inset the carrier into a tube which is under pressure in both cases. The receiving apparatus at the main Post Office simply discharges the carrier from the end of the tube where the pressure has about disappeared, while at the Produce Exchange the discharge, as well as insertion of the carrier, must be from a tube under pressure, and this must be done without an annoying blast of air.

The resulting receiving apparatus will be seen from Fig. 4 to be a much more elaborate piece of machinery than the receiver at the Post Office. The carriers come in through the tube at the top, which will be seen to enter the room through an opening in the wall, and to be connected with a dead end in the foreground. This dead end is mounted on trunnions, and, on receiving the carrier, is tilted from its normal horizontal position, and discharges the carrier from the end at which it entered. A section of this receiver is shown in Fig. 5. The air and carrier enter from the left in Fig. 5, the former passing on through the lantern shown, while the carrier passes into the dead end, its motion being destroyed as before by the cushion in front of it. To regulate this cushion and avoid rebound of the carrier into the tube, an adjustable valve *a* is inserted, the air from which is carried, as shown, to the base of the machine and the atmosphere. A pipe, not shown, connects through the trunnion at *b*, with the valve of cylinder *c*. The cushion pressure operates this valve, which admits air from the main to the lower end of cylinder *c*, causing its piston to rise and bodily tilt the dead end on its trunnion until it occupies the direction of the line *b d*. A cylindrical shield *e* prevents the escape of air from the main, while air supplied by pipe *f*, which is now brought in front of the main, ejects the carrier on to the receiving surface *g* and buffer *h*. Striking buffer *h* operates lever *i*, which reverses the valve of cylinder *c*, causing it to return the dead end to place, while the weight of the carrier overbalances weight *j* and causes the receiving surface *g* to swing down to a horizontal position, when the carrier rolls out on the receiving table shown in Fig. 4.

A row of carriers will be seen standing on end on the floor of Fig. 4, from which an idea of their size and appearance will be obtained. They are of sheet steel, 7 inches diameter by 24 inches long, with two leather packing rings which bring the over all diameter up to that of the bore of the tube—8 inches. This difference in the diameter of the case and rings is necessary to permit the carriers to go around the bends in the pipe.

The pipe is of cast iron, bored of course, and with bored and turned male and female ends to insure accurate alignment.

The capacity of the carriers being about 500 letters, and the time limit between carriers being 10 seconds, it will be seen that the capacity of the tube is about 3,000 letters per minute. This is, of course, far beyond all possible requirements. The size of the tube, however, permits its use for the great bulk of package mail, and it is this service which has determined the size.

We may say, in conclusion, that the chief saving due to this system of transit does not lie in the mere saving of time in transit. With wagon distribution, only occasional trips are possible, leading to long delays at the sending station. On the other hand, the arrival of a wagon load of mail at the receiving station leads to a congestion of matter and further delay in distribution. The chief gain with this system lies in the fact that the mail is sent in small but frequent trips without loss of time in waiting for a large accumulation, and also without the loss of time incident to the distribution of a large bulk of matter delivered in one shipment.

Additional tubes are now being laid down, and there is no doubt that New York will soon have the best system of local mail service of any city in the world. We have in the past been behind European cities in this respect, but this will soon be more than made up.

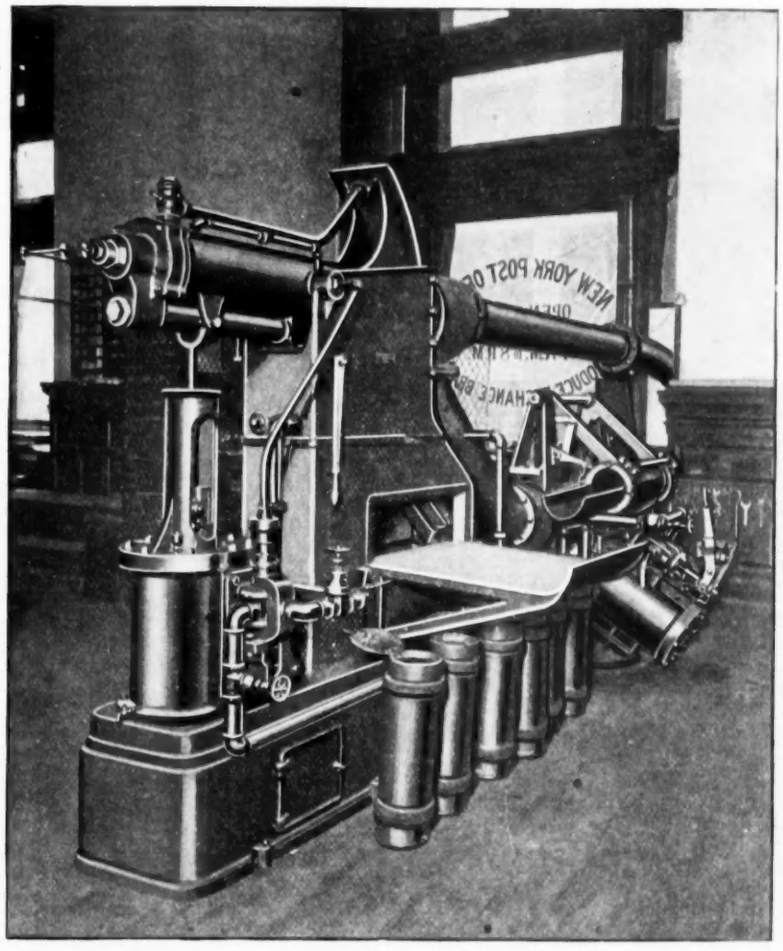

FIG. 4.—PRODUCE EXCHANGE BRANCH STATION.

The Stretch of Transmission Ropes.

Some time ago we received the following inquiry:

About how much does a hemp rope stretch when used for power transmission and not overloaded? That is, how much per cent. will it stretch in the first week or so until the permanent splice is made, and how much after that? Also, how much, about, does variation of the weather affect a rope which is sheltered so that rain does not get on it, and how many feet travel should the tension carriage have for each 100 feet of rope in the drive?

We referred the matter to Mr. C. W. Hunt, and from him have the following reply:

Hemp rope is not used in the United States for rope transmission. Manila rope usually stretches about 5 or 6 per cent. during its life, where it is not overloaded.

There is no data available to ascertain the amount of stretch in the first and second week or month, but, speaking generally, in the course of a couple of months the rope usually ceases to stretch rapidly and thereafter the stretch is very slow, and I think quite regular.

Transmission rope that is protected from rain is but little affected, but all rope is subject to slight extension and contraction from the hydrometric changes in the atmosphere. The kind that we manufacture, "Stevedore" rope, is treated with a waterproof lubricant which reduces the effect of the weather to quite a small amount; far less than untreated manila, but the amount has not been definitely measured. If the rope runs where rain gets upon it, then a tension pulley must always be used, as the extension and contraction of the rope is so great that no other method will take care of the slack.

The travel of the tension carriage is usually made as great as possible because there is not generally room enough for it to extend as much as the rope will stretch during its life. When the tension carriage is fully extended from the stretch of the rope, the rope is shortened and respliced.

A curious incident is related by Mr. Robert Cartwright, of Rochester, who put in a rope drive with a tension pulley, to transmit power from the water wheel to the shafting in the mill. In this case they had a long range for the tension pulley carriage. I have not time at present to look up the data to get the exact figures, but the rope was about 2,000 feet long and the tension carriage had a run of about 30 feet. This rope was run until the preliminary stretch was out; then shortened and respliced with the tension pulley as far in it as it could go. This ran steadily until the tension pulley was very near its extreme run. The water power then failing, the mills were run by steam for three months, the rope being left in position exactly as it was when in use. During the three months the rope

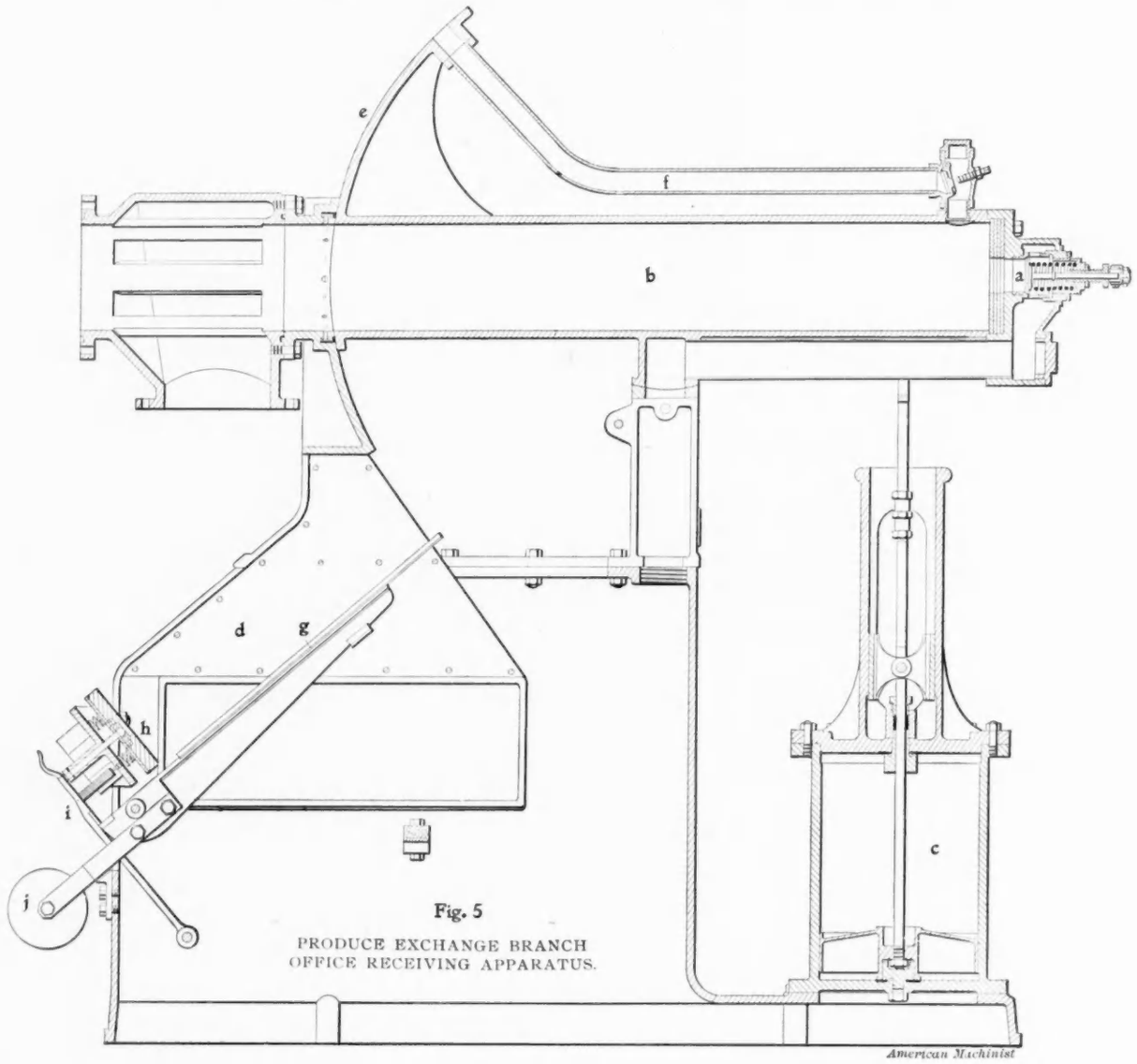

Fig. 5

PRODUCE EXCHANGE BRANCH OFFICE RECEIVING APPARATUS.

gradually shortened until the tension pulley was drawn in to the extreme limit, thus taking up all the stretch that had come into the rope. I have been unable to account for this, especially as the tension weight was kept on the pulley during the whole time.

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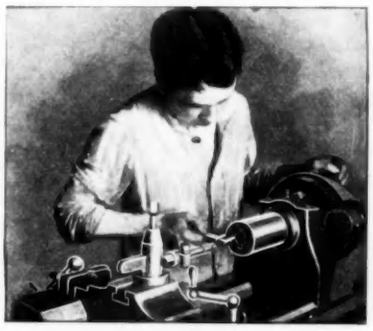
Slotting in the Lathe.

BY JOHN RANDOL.

I do not think there are many of the tool-makers of to-day who look on the lathe as a likely slotting machine. In the old times, when shops considered well equipped had nothing but lathes, and hand lathes at that, the hammer and chisel did all the slotting and planing, and even the heavy screw cutting. Then came the engine lathes, with chain-driven carriages, many of which had large wooden hand wheels, by means of which the carriage could be driven quite strongly with the hand. When these elegant tools came in they were often made with a metal plate, with several rows of index holes let into the forward end of the largest step of the wooden cone on the lathe spindle, and an index pin on a swinging lever was provided, so that a piece of work on the lathe centres could be indexed in ordinary divisions, and with this dividing rig and the big hand wheel on the carriage taps were grooved, and the fine tooth mills of those days were cut, and many small odd jobs of this sort were thus done rapidly and well—jobs which would to-day call for the lathe and milling machine, or lathe and planer, or perhaps all three. All of this sounds very old fashioned to readers of this generation, yet the chain lathes were the best in the world hardly more than fifty years ago. I well remember the best lathe in my first shop. It had a mahogany cone, with a brass index plate, and it had six lead-screws, each about 3 feet long, to be shipped in place according to the thread to be cut; they were all of different pitch, and were unshipped and put away in a box when the thread cutting was done. There were only a few pieces of change gearing, but by having six lead-screws a great range of threads was obtained. This lathe had mahogany sheers, with a double-V cast-iron way screwed to each timber of the sheers with wood-screws, and it was run by Andy Moore, who was an excellent lathe hand and tool-maker, and fluted the taps and rose-bits on his lathe (which no one else was allowed to touch), after he had done the turning. After a while the shop got a screw planer from Nashua, N. H., one of the first American made planers, but Andy always finished all of his work in the lathe, because, as he said, he was sure it would "come true."

All of this was brought back very plainly to my mind by seeing a tool-maker in the Crawford cycle shop doing a slotting job in the lathe—not for want of milling machines or planers, but for Andy Moore's old reason, "because it was sure to come true."

The job was the cast-iron body of a large hollow mill, for what use I do not know, although I saw the drawing. The Crawford shop uses machinist draftsmen, and they don't write anything on the drawings. But I took pictures of the job, as I considered it a really useful hint. The lathe was a short "Reed," made to order for cycle work. It had a very strong saddle gear and a heavy, rigid saddle, as are necessary for the modern cycle shop, and this tool-maker who wanted his work to come true, had screwed his mill body to the spindle of the lathe and bored and turned it in the ordinary manner. He then proceeded to cut four cutter seats on the inside of this mill stock, using a boring tool stock—quite clearly shown in the engravings. As the boring tool was fitted to hold inserted cutters, it was easy to slot the four



SLOTTING IN THE LATHE.

tool-seats, first with a ¼-inch cutter and to finish them with a ⅜-inch tool, using the cone gear for an index. No such cut as this could have been taken on the "grasshopper" saddle of Andy Moore's lathe, but his spirit undoubtedly approved of the bicycle shop job, if it was aware of the procedure.

It is very easy to take quite a good-sized planing chip with the stiff, strongly geared saddles of our present engine lathes, and there are many cases where it is really economical to make a planer cut in the lathe in the tool-room. In the shop, on regular work, something else is better. In the old days there was no regular work. It was all "jobs," and every job was "special" in so much as there were never what would now be considered the tools indispensably necessary for its production. In those days we could not buy a stem-winding, stem-setting watch for a dollar and a quarter, nor a sewing machine for $15 nor a bicycle for $50. The sewing machine was just coming into use fifty years ago, the bosses carried silver watches that cost $30 or $40, and the bicycle was yet to come. A few years later the sewing machine began to educate the machinists up to armory methods; later the country watch factories distributed accurate shop practice very largely in America, and now, last of all, the bicycle manufacturer has carried the most advanced metal working methods almost everywhere. The next great mechanical educator will be the motocycle, which will just about begin with 1900 to be the one thing which cannot be built fast enough.

It is a long way from the chain-feed lathe to the bicycle shop, and only a little way from the bicycle to the motocycle, and there is more work for machinists and machine shops to do in the next fifty years than all the trade has ever done before by a hundredfold, and the good hand of the future will be just what the good hand was in the old days—the man who looks ahead a little bit, and who can see easy ways to do his work without having to use a shopful of tools for every job he touches, and especially the man who likes to see his work "come true," and finds ways to make it come as he likes it.

It was very easy to bring the slotting uniform in the mill body; as shown in the engraving the depth of the tool-seats was easy to measure, and simple as this job may appear, it has the great merit of being unusual practice, and at the same time good practice, and hence a thing to be remembered.

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A French Engineer on American Shop Management.

A recent visitor to this country from France, a French officer of engineers, is reported by a Philadelphia paper as having said:

"I have been in America six months, and have visited the mines and manufacturing establishments in the East, West, North and South. I have seen the most gigantic engineering operations and the most powerful machinery in the world, but I shall report to my Government that the biggest things in America are the little things. * * * The French people are experts in domestic economy, and live comfortably by saving what your average families throw away. But Americans are, on the other hand, experts in industrial economy. You make money by saving wastage in business, and you lose some of it by wastage in your domestic economy. The attention paid to small details in your big works is amazing to me; I have visited some establishments where I believe the profits are made not in the manufacture proper, but in the saving of materials and labor by close attention to details that are with us unconsidered trifles. For example, I saw in your shops just now a little grindstone in operation automatically sharpening

lathe and planer tools. This machine cost, probably, as much as a hundred of our ordinary grindstones cost, but I see that it automatically grinds all the tools for 300 high-priced mechanics, and it only works a few hours each day. The skilled mechanics in our country frequently stop their regular work to grind their own tools, and then they do it imperfectly. Your tools are all accurately ground to the best shape by the machine, so that they do more and better work on this account in a given time. I believe that that machine has brains—the brains of the inventor—and it has no doubt revolutionized work of this kind in American machine shops. This is but one case out of many that I have noted."

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The Fox Machine Company, of Grand Rapids, Mich., has applied a bicycle chain to the movement of the knife carriage of their universal trimmer. This chain takes the place of the rack and pinion and is applied at about the middle of the vertical hight of the carriage, thus doing away with practically all tendency to cramp the carriage within the sliding ways. The result is declared to be a very considerable improvement.

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Our British contemporary, "The Engineer," names among the important engineering achievements of the past year the great light it has thrown upon the matter of relative railroad speeds in America and England. Over here, however, it seems as though that light has flickered considerably.

Modern Practice with Worm Gearing.—II.

BY F. A. HALSEY.

EXAMPLES FROM PRACTICE.

It is impossible to say who was the first to recognize the significance of the pitch angle as a factor in the satisfactory performance of worm gearing, but it may be mentioned as a matter of interest that the exhibit of the Hewes & Phillips Iron Works at the Newark Industral Exhibition of 1873 included several worm-driven planers, in which the worms were double threaded and had a pitch angle of 15° 15′, a pitch diameter of 3½ inches, a pitch of 3 inches, and a speed, cutting, of 256 and backing of 640 r. p. m., which give pitch line velocities of 237 and 590 feet. This worm was successful, and was many times repeated; but later on Hewes & Phillips were struck by the high belt speed idea, and in order to increase the belt speed they changed the worm to 6.16 p. d., 1¾ inches pitch, single thread; speed, cutting, 446, and backing 1,110 r. p. m., giving a pitch angle of 5° 15′ and pitch line velocities of 720 and 1780 feet. This worm was a failure, and was soon changed to 6.16 p. d., 3½ inches pitch, double thread; speed, cutting, 281, and backing 700 r. p. m., giving an angle of 10° 15′ and pitch line velocities of 452 and 1,130 feet. This worm did better than the last, but not so well as the first. By this time the lesson was learned, and Hewes & Phillips set out to use a worm of 30 degrees pitch angle. Structural considerations, however, prevented the use of so high an angle and they compromised on 20 degrees, the final worm resulting from this experience having a pitch diameter of 2.63 inches, with 3 inches pitch, quadruple thread, the speed cutting being 300 and backing 700 r. p. m., giving pitch line velocities of 205 and 480 feet, and this remained the standard angle as long as these planers were manufactured. The writer recently saw one of these 20 degree worm gears, which had been in use since 1885, opened up, and the wear disclosed was very slight—no shoulder being in existence after twelve years' use. As a result of the experience outlined above this house adopted the standard practice of making the worms as small as possible in diameter, and giving the threads in all cases a pitch angle of 20 degrees. The form of tooth used was the epicychloidal, while the materials used were hard cast iron for the gear and case-hardened open-hearth steel for the worms.

These Hewes & Phillips worms are plotted in Fig. 3 as crosses 1, 2, 3, 4, of which 1 is the 15° 15′, 2 the 5° 15′, 3 the 10° 15′ and 4 the 20°, the first and last being successes and the second and third failures.

In plotting these worms, and all others having pitch line velocities above 200 feet, the crosses are placed near and above the 200 feet curve. It is unfortunate that we have no curves for higher speeds, but Mr. Lewis recommends the use of the 200 feet line for all higher speeds. Leaders connecting different crosses indicate the same worm at different speeds in all cases. The letters *s* and *u* on the dia-

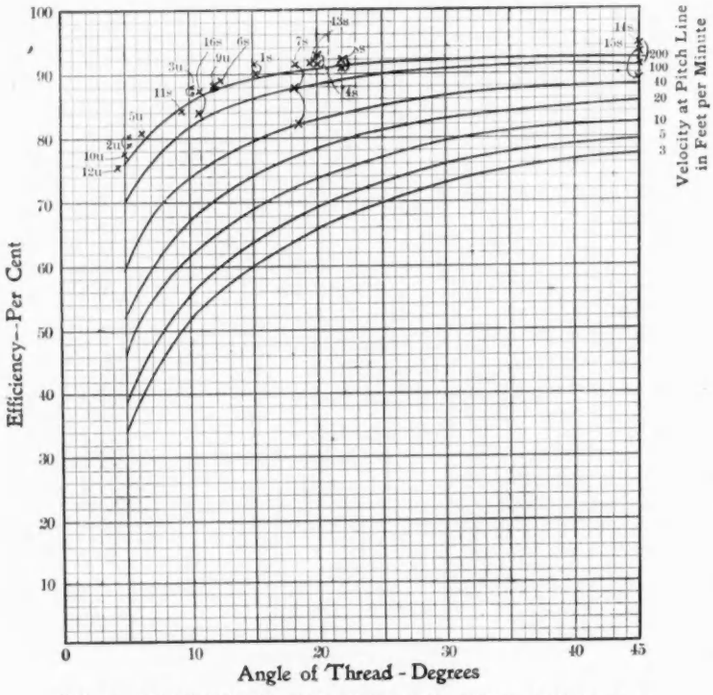

FIG. 3.—RELATION BETWEEN THREAD ANGLE, SPEED AND EFFICIENCY, WITH CASES FROM PRACTICE.

1. Hewes & Phillips, successful, velocity	237 and 590	ft.,	steel	worm	and	cast iron	gear.
2. Hewes & Phillips, unsuccessful, velocity	720 " 1,780	"	"	"	"	"	"
3. Hewes & Phillips, unsuccessful, velocity	452 " 1,130	"	"	"	"	"	"
4. Hewes & Phillips, successful, velocity	205 " 480	"	"	"	"	"	"
5. Newton Machine Tool Works, unsuccessful, velocity	572	"	"	"	"	bronze	"
6. Newton Machine Tool Works, successful, velocity	375	"	"	"	"	"	"
7. Newton Machine Tool Works, successful, velocity	40 to 685	"	"	"	"	"	"
8. Bertram & Sons, successful, velocity	155 and 620	"	cast iron	"	"	cast iron	"
9. Anonymous, unsuccessful, velocity	250	"	steel	"	"	bronze	"
10. Christie, unsuccessful, velocity	215	"	"	"	"	cast iron	"
11. Christie, successful, velocity	190	"	"	"	"	"	"
12. Christie, unsuccessful, velocity	775	"	"	"	"	bronze	"
13. Christie, successful, velocity	328	"	"	"	"	"	"
14. Anonymous, successful, velocity	116 to 555	"	cast iron	"	"	cast iron	"
15. Anonymous, successful, velocity	53 " 277	"	"	"	"	"	"
16. Anonymous, successful, velocity	118 " 860	"	steel	"	"	bronze	"

Leaders connecting crosses indicate the same worm at different speeds; resistance of crosses above 200 foot line has no quantitative significance.

gram mean successful or unsuccessful in all cases.

Fig. 4 is a drawing of worm 3 (failure) and figure 5 shows worm 4 (success), and no more instructive pair of drawings could be imagined than these. The pitches are not far different, and what difference there is is in favor of the larger worm. The duty is the same, the gears are about the same diameter, and the revolutions per minute are nearly the same. The essential change is in the increase of the pitch angle by a reduction of the diameter, and this changed failure to success.

The Newton Machine Tool Works use worm gear in many of their machines, notably their cold saw cutting-off machines. In the earlier machines of this class the worm had a pitch diameter of 2⅞ inches, with a pitch of 1 inch, single thread, the revolutions per minute being 765. These figures give a pitch angle of 6° 20′, and a pitch line velocity of 572 feet. This machine could be operated, but not with satisfaction on account of the heating and short life of the worm. The worm was then increased in pitch by making it double threaded, giving a pitch angle of 12° 30′, the speed being reduced to 500 revolutions per minute, giving a pitch line velocity of 375 feet. The change proved to be a great improvement, heavier work than was before possible being done after the change without distress or difficulty, and this worm has since been applied to a large number of machines with entire success. A still later worm used on these machines has a pitch diameter of 3⅞ inches and a pitch of 4 inches, triple threads, giving a pitch angle of 18° 15′, and this is found to be a still further improvement. This last worm is used on a wide variety of machines and at a variety of speeds from 40 to 680 r. p. m., giving pitch line velocities of from 40 to 685 feet, and with uniformly good results. In many cases it is used without an oil cellar, though for comparatively light work. The form of thread used is the involute, and the material is hardened steel for the worm and bronze for the wheel. These Newton worms appear in Fig. 3 as 5, 6, 7, of which 5 is nearly a failure, while 6 and 7 are entirely successful. The second Newton worm—the one appearing in Fig. 3 as 6—is shown in Fig. 6.

Another habitual user of worms is John Bertram & Sons, of Dundas, Ontario, Canada, who employ them in all their planers, and use largely a worm of 3.18 inches pitch diameter, 4 inches pitch, quadruple threads, the speed, cutting, being 186 and reversing 744 r. p. m. These figures give a pitch angle of 22 degrees, and pitch line velocities of 155 and 620 feet. This worm appears in Fig. 3 as 8, the vertical position for the higher speed being again uncertain. These worms are highly successful, as the writer knows from repeated observation. Both worm and wheel are of cast iron, the thread being Brown & Sharpe standard. The Bertram worm is seen in Fig. 7. In reading this drawing it should be remembered that the conventional representation of a worm, with the threads shown by straight lines, shows a larger apparent pitch angle than the true one, as shown by a true projection.

Another case of failure was a worm drive applied to a large boring machine, the worm being 12 inches pitch diameter, 8 inches pitch, quadruple thread, speed 80 r. p. m. and above, worm of forged steel, wheel of bronze, oil cellar lubrication. These figures give a pitch angle of 12 degrees and a pitch line velocity of 250 feet. This worm is located on Fig. 3 as 9.

Still other cases of change from failure to success are supplied by Mr. Jas. Christie, of the Pencoyd Iron Works. The first of these relates to a boring machine, which was, by the makers, supplied with a worm drive having a worm 5½ inches pitch diameter, 1½ inch pitch, single thread, steel worm and cast-iron wheel, average speed 150 r. p. m. These figures give a pitch angle of 5 degrees and a pitch line velocity of 215 feet. This was a failure, but was successfully replaced by a worm of 4⅞ inches pitch diameter, 2½ inches pitch, at the same number of revolutions, which figures give a pitch angle of 9° 15′ and a pitch line speed of 190 feet. These two worms appear as 10 and 11. This successful worm lies in the region of unsuccessful ones, but the influence of the increased lead angle is unmistakable. The fact of its success is probably due to the pressure on the teeth being well below the working strength, or to the speed being moderate, or both.

The second case, of which the data were supplied by Mr. Christie, relates to two heavy milling machines, in which the cutter spindles were driven by worms 6 inches pitch diameter by 1½ inch pitch, single thread. It was found that the cutters could be run much faster than was originally contemplated, and the worms

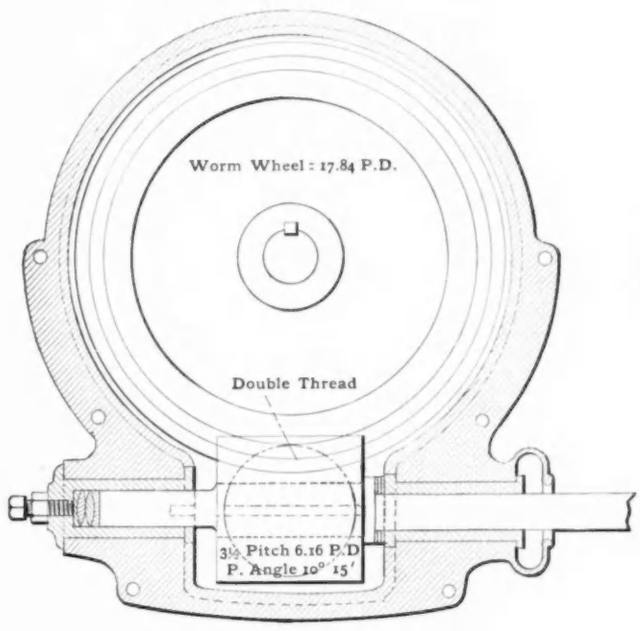

Fig. 4

HEWES & PHILLIPS' UNSUCCESSFUL WORM.

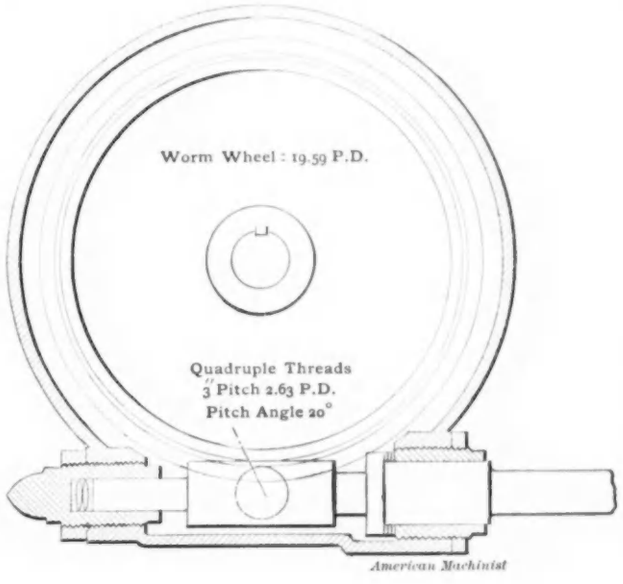

Fig. 5

HEWES & PHILLIPS' SUCCESSFUL WORM.

were consequently speeded up to about 500 r. p. m. In these machines cast-iron wheels were speedily destroyed, while hardened steel worms and bronze wheels would last about a year. Later two more machines were built having steel worms and bronze wheels, the worms being 4½ inches pitch diameter by 5 inches pitch, quadruple threads, speed 280 r. p. m. These worms have been in use six years, and are described as being "good as new." The data given for the first worm give a pitch angle of 4° 30′ and a pitch line velocity of 785 feet. It appears in Fig. 3 as 12. The pitch angle of the second worm is 19° 30′, and its pitch line velocity 328 feet. It appears in Fig. 3 as 13.

Mr. Christie has made many successful changes, of which these are typical, and he now uses worms with great freedom and success. His general conclusion is that good worms begin with those having the pitch about equal to the diameter, giving a pitch angle of 17° 15′.

Three other cases of successful worms under heavy duty are found in milling machines which have been repeated many times. The first two worms would be ordinarily described as spiral gears. The shafts are at right angles and the action is that of worms, and they are properly included here.

The first of these, which appears as 14 in the diagram, has a pitch diameter of 2¼ inches, a pitch angle of 45°, and a speed varying between 180 and 945 r. p. m., giving pitch line velocities of 106 to 555 feet per minute. Both gears are of cast iron. The second, 15 in the diagram, is of the same style, and has the same pitch diameter, with speeds varying between 90 and 472 r. p. m., giving pitch line velocities of 53 to 277 feet per minute. The third, 16 in the diagram, is a true worm, 2¼ inches pitch diameter, lead 1.333, triple thread, speed 200 to 1,442 r. p. m., bronze wheel and hardened steel worm. These figures give a pitch angle of 10° 45′, and a pitch line velocity of 118 to 845 feet per minute. While this worm is entirely successful, it was at first a failure, and was made successful only by careful attention to the materials used.

LIMITING SPEEDS AND PRESSURES.

A very important point connected with worm design, and one on which data are very scant, is the limiting pressures for various speeds at which cutting begins. The paper by Mr. Lewis contains some information on this subject, and the accompanying table supplied by Mr. Christie, from experiments made by him, supplies the most definite additional data on the subject known to the writer. In all cases the worms were of hardened steel and the worm wheels of cast iron. Lubrication by an oil bath.

There is real need of a comprehensive series of experiments on this subject. It is obvious enough that a worm, otherwise well designed, might fail from having too high a speed for its load. Were such data at hand it would seem that with existing knowledge of effect of the speed and angle of the thread, worm design might be made a matter of comparative certainty. Especially should the behavior of worms at speeds above 200 feet per minute be subjected to further experiment, as it is frequently necessary to use speeds above that figure, and there can be no doubt that higher speeds are entirely feasible if suitable pressures accompany them. The speed as a factor should be kept in mind equally with the pitch angle. A worm may fail because of too high a pitch line velocity as well as because of too low a pitch angle.

The number of cases cited is too few for certainty in drawing general conclusions, but the testimony is unmistakable in its confirmation of the theory of the influence of the angle of the thread. It will be seen that every case having an angle above 12° 30′ was successful, and every case below 9° unsuccessful, the overlapping of the successful and unsuccessful worms in the intervening region being what is to be expected in the border region between good and bad practice. This band of uncertain results is in fact narrower than we would have any right to expect from a collection of data from miscellaneous sources, and could the inquiry be widened in scope the width of this band would doubtless be increased. As throwing light on these cases it should be remembered that case 16 is known to have been made successful only by careful attention to the material used, the first worms made having been failures, and that 3, which is near 16, and was a failure, had an excessive speed, while 11 at a lower angle, and a success, had a very moderate speed. At a higher speed 11 would probably have failed, and at a lower speed 3 would probably have been a success. It is believed that Fig. 3 points out clearly the nature of the worm problem and the conditions of success in its solution.

	Single Thread Worm 1″ Pitch 2⅞ Pitch Diam.				Double Thread Worm 2″ Pitch 2⅞ Pitch Diam.			Double Thread Worm 2½″ Pitch 4½ Pitch Diam.		
Revolutions per min ..	128	201	272	425	128	201	272	201	272	425
Velocity at pitch line in feet per min.....	96	150	205	320	96	150	205	235	319	498
Limiting pressure in pounds.....	1,700	1,300	1,100	700	1,100	1,100	1,100	1,100	700	400

LIMITING SPEEDS AND PRESSURES OF WORM GEARING.

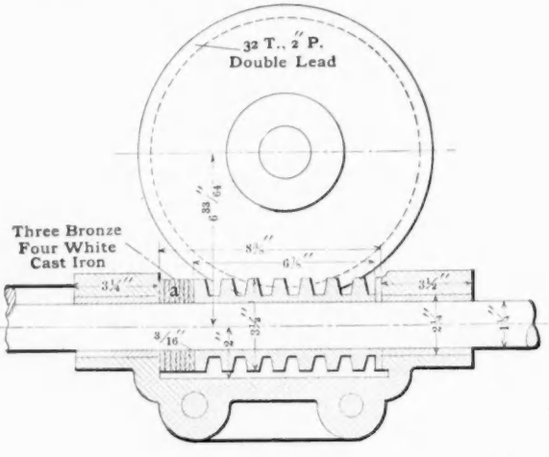

Fig. 6

THE NEWTON WORM AND STEP.

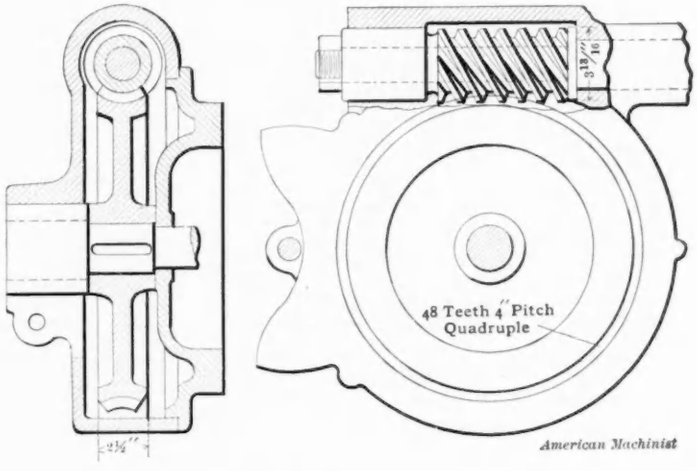

Fig. 7

THE BERTRAM WORM.

STEP BEARINGS.

The step bearings of worms have been a source of trouble alongside of the worm

itself. It is obvious enough that the increase of the thread angle will relieve the step of wear as well as the worm threads. Expedients are possible with the step, however, which are not available with the worm. Ball and roller step bearings have been extensively used, and while some have been successful with them, the general results are believed to have been unsatisfactory. The troubles from ball bearings arise from the tendency of the balls to break up under heavy loads and to score the pressure plates, while conical rollers, which geometrical considerations call for, have in some instances made trouble from their outward radial pressure cutting out the confining ring. The multiple washer thrust bearing is used by many, and is undoubtedly entirely successful. Many of the readers of this article have no doubt seen this pattern of bearing without reflecting upon the principle which lies at the bottom of it. When several loose washers are interposed between the shaft collar and the face of the shaft bearing, it is obvious that slipping may occur between any pair of faces, and that this slipping will take place between those surfaces which at the moment offer the least friction. Should these surfaces from any cause increase their resistance the slipping will be at once transferred to another point, the various surfaces acting as mutual safety valves to one another, any surface which gets into the condition of incipient heating or cutting being at once relieved by another taking up the work. Fig. 6 shows one of these bearings as made by the Newton Machine Tool Works. The Newton Works formerly followed the usual practice and made the washers *a* alternately of hardened steel and bronze, but consider that they have improved on this by substituting white cast iron for the steel. These castings are obtained from the malleable iron foundries, and are in fact unannealed malleable castings. Of course these castings cannot be machined, and they are therefore prepared for use by grinding on a cup-shaped emery wheel. They are dropped into a socket on the end of a shaft, which is revolved by hand, and are thus presented to the face of the cup-shaped wheel. This plan results in the grinding marks crossing the faces in all directions, instead of being in circles as in lathe-finished pieces. All mechanics understand the advantage of having the tool marks in a direction different from that of the motion of the parts, which advantage this method of construction secures. Another feature of the Newton bearings consists in making the holes in the washers larger than the shaft on which they are placed. This construction introduces an irregular compound motion of the surfaces upon one another, the advantages of which are well understood. In the Newton washers the holes are 1-32 inch larger than the shaft, though Mr. Newton considers that this might be increased with probably good results.

Three radial oil grooves are cast in each face of these disks, the use of which is obvious. The Hewes & Phillips step, at the right-hand bearing, will be seen to include three washers, while the left-hand step has lenticular-shaped disks—a pattern which has also found favor elsewhere.

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Errata.

In spite of careful corrections of proof, our printer made a general mess of the formulas which appeared in last week's installment of the article on "Modern Practice with Worm Gearing." The first equation for the efficiency of worms without steps should have read

$$e=\frac{\tan\alpha\,(1-f\tan\alpha)}{\tan\alpha+f}$$

in which

e = efficiency.

α = angle of thread, being the angle $d\,f\,i$ of Fig. 1.

f = coefficient of friction.

The equation for the efficiency of worms with steps should have read:

$$e=\frac{\tan\alpha\,(1-f\tan\alpha)}{\tan\alpha+2f}\quad\text{(approximately)}.$$

The equation for tan α at maximum efficiency of worm thread alone should have read:

$$\tan\alpha=\sqrt{1+f^2}-f$$

Substituting the value of f (.05) this becomes

tan α for maximum efficiency = .9512.

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Electrical Distribution of Power.

BY WILLIAM O. WEBBER.

I was recently somewhat surprised to read that the driving of factories by electric motors in Europe and on the continent is still regarded as an experimental or problematical thing to do. And yet I do not think that the advantages to be derived from this method of driving are as yet fully appreciated in this country. In recent years it has been my privilege to plan out the electrical driving for a number of factories of different kinds, and I have always, in the first place, ascertained just what saving could be made by driving factories electrically, both from steam and water power as a source, as against driving them directly by shafting and belting. I think, in the first place, that very few people realize the large per cent. of loss in factories of all kinds due to shafting and belting. The per cent. of loss in this way is not only very great, but very variable, and it not only varies very largely from one type of factory to another, but there is also a large variation in different factories of the same type and doing the same class of work. Probably one of the best examples of a small loss of power from these causes is a modern high speed cotton mill, where the total loss does not exceed 18 per cent., whereas some of the older cotton factories lose as much as 25 per cent. To go to the other extreme, the largest loss is in such plants as large locomotive works, boiler shops, bridge works and other plants, where the machine tools are large and are distributed at intervals over a large floor area. In this type of factory the loss, determined by actual tests, runs as high as 80 per cent. Machine shops and wood-working establishments probably come next, the loss being from 50 to 60 per cent., and I have recently tested some woollen and felting mills where the per cent. of loss was from 35 to 40 per cent. I have also made a number of tests recently in warehouse buildings, in large cities where power is furnished to a number of small industries on each floor, and in these cases the loss of power in shafting and belting is a very large per cent. of the total power developed by the engines.

Another very much misunderstood question is that of the relative cost of steam and water power. Of late years there has been a very strong prejudice in favor of steam power, it being generally believed that, by reason of improved boilers and engines, almost all steam power could be produced for $25 per horse-power per year; whereas, as a matter of fact, it is only in large factories, using large compound condensing engines, that this figure can be attained. The ordinary small factory, with an engine of, say, from 100 to 125 horse-power, running 10 hours per day for 308 days in the year, with coal at $3 per ton, will find it impossible to produce a horse-power for less than $53 per annum; and if the same factory is run 365 days in the year, 24 hours per day, the cost on the same basis would be $76, or, if run 24 hours per day for 308 days in the year on the same basis, the cost per annum would be $69. On smaller engines than these just cited the costs would be increased; so that for 308 days of 10 hours the power for a 50 horse-power engine would be nearly $100 per annum.

On the other hand, as we go toward larger plants, these costs decrease, so that 200 horse-power should be obtained for $45; 300 horse-power, for $37.50; 400 horse-power, for $33; 500 horse-power, for $30 per horse-power; and I find that we do not reach the figure of $25 per horse-power until we get as high as 850 horse-power. As the extreme low limit, I believe recent figures of a large thread mill making 2,000 horse-power under extremely favorable conditions, have brought the cost slightly under $12 per horse-power; but this is exceptional.

On the other hand, the horse-power from falling water is relatively much cheaper for small plants. I believe that a small 100 horse-power water plant would produce a horse-power for $33 per annum, and 200 horse-power from water has been produced for $13 per annum,

with the cost for different sized powers between these two extremes varying very closely in proportion to size of power developed. One great advantage of water power is that it costs no more for a given horse-power for 24 hours per day, 365 days per year, than it does for 10 hours per day, 308 days in the year.

That these facts have been pretty generally recognized during the last year or two is proved by the fact that a number of water-power companies stand ready to furnish water horse-power transmitted by electricity in their immediate vicinity for $25, and to a distance of 10 miles for $35 per horse-power per annum, on the 10 hour basis, and at a relatively slight advance on the 24 hour basis; and I believe that there are very many small water powers, as well as some larger ones, not only in this country, but all over England and Europe, which could be profitably developed for transmission in this way.

Another item of considerable expense regarding steam power as generally supplied is that the consumer must pay for the maximum amount of power required, whether he uses it or not, while with electrical power, whether produced by steam or water, he pays only for the net horse-power which he uses as measured to him by meters, this alone showing a very large saving. It is also a fact that a person having a steam or water power plant from which power is distributed by belting and shafting can sell only such amounts of power as will add up to the gross amount of power which his plant will produce; whereas with electrical power it is possible to sell fully 125 per cent. of the gross amount of power produced by the plant, paradoxical as this may seem.

There are also some very peculiar situations developed by the buying and selling of power by the old method. I remember once being called in to test the amount of power used for the tenants in a certain building, where the power was furnished by the owner, to enable them to ascertain just how much power they should be called upon to pay for, and they found, somewhat to their surprise, that they were paying for considerably more power than they were using. I went to some of the other tenants and suggested that they should have their power tested for the same reason; but was met by the rather staggering argument that they were paying for, say, only 10 horse-power, while they knew they were using fully 20 horse-power. I then went to the owner of the building and suggested that it might be to his advantage to have the power tested by indicator cards from his engines to show the total amount and the different amounts of power which he was furnishing to each tenant, and was met by the equally staggering argument that he had only a 100 horse-power boiler and engine, but that he was collecting rent for 125 horse-power from his tenants; so he did not care to have the power tested.

The consideration which largely deters consumers of power from abandoning their present methods and producing electrical horse-power and distributing it to different parts of their factories by motors is the first cost of motors and of electrical installation. I have recently figured this up for a number of small factories, where the size of the motors would average about 10 horse-power, and where from 10 to 20 motors would become necessary, and find that on a basis of $35 per horse-power per year for a constant supply of 100 horse-power, taking the interest on the motors and electrical installation at 6 per cent., the depreciation at 10 per cent., taxes at 2 per cent. and insurance at 1 per cent., and including repairs, atendance, etc., on the 308 day, 10 hour basis, the total cost would not exceed $52 per horse-power per annum. On the 308 day, 24 hour basis, it would not exceed $57 per horse-power per annum, and on the 365 day, 24 hour basis, charging $47 per horse-power per annum for electrical power for 120 horse-power, it would not exceed $66 per horse-power per annum; and in considering these figures it should be remembered that they must be computed for amounts of power as a total average, or if the total power was this amount, the net horse-power would average fully 25 per cent. below these figures.

Of course, it is impossible to lay down any absolute set of figures which will cover every case of this kind, as local conditions, the use of steam for manufacturing purposes other than power, and many other contingencies, would lower the results in such cases, so that they would have to be computed individually and intelligently, from observations made at the plant in question; but that in 99 per cent. of the cases a very material saving could be made by electrical distribution, even from the present steam plant, and a very large saving by the development of small water powers within a radius of ten miles, or by the purchase of electrical power from already existing plants, which do not use the present capacity of their plants for the whole twenty-four hours of the day, is a fact that has gone by the experimental or theoretical stage, and may be, after the manner of a problem in Euclid, concluded with the initials "Q. E. D."

Boston, Mass.

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The longer the British engineering strike goes on the more apparent it becomes that its outcome will have an important influence upon American exports of machine tools. The discussion of methods now going on will inevitably benefit our trade.

Chainless Bicycles.

There is much to warrant the belief that the word "chainless" is in the near future to be used to conjure many dollars out of the pockets of credulous and over sanguine wheelmen. It will be very proper for all to remember, even if they have to exert themselves a little to keep the fact in mind, that no loud and persistent iteration of this magic word does really effect any actual deterioration of the now almost universal chain and sprocket. The chain is not a bit worse, is as good in every particular as it was before the chainless din began to be heard. We are saying not a word here as to whether some of the novel chainless devices are any better, or as good as, or not as good as the chain-driven wheel, but we merely wish to insist that the term chainless is not necessarily an adjective which guarantees superlative excellence, or, indeed, carries the slightest presumption of improvement. Chainless is a negative term, and means simply, just as crankless or tubeless might mean, something different in style of construction or in means of propulsion. The chainless wheel being simply something different, it should be examined and tried upon that basis. The fairest of fair play is surely enough to accord it. Superiority in service will not eventually be determined by nomenclature, however it may sound at the beginning. The makers of wheels have generally, and most successfully, striven to produce in every detail the most excellent and reliable machine that man could imagine, and have indeed gone far beyond what those best informed would a few years ago have dared to hope for. We may be assured that now that the chainless feature is employing their best talent, both in designing and in manufacturing, the product will be at least worthy of most respectful consideration, as it must also invite all honest criticism.

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Radial Driller.

We present herewith illustrations of a radial driller, in the design of which it has been the object to embody those features which experience has shown to be desirable in machines of its class, and at the same time so arrange as to add to the convenience of the operator, and thus facilitate his work.

The machine is so designed that by means of the lever shown in front of the arm, and just at the right of the post, it can be started, stopped, the back gears engaged and the spindle reversed at a fast speed for tapping, without resorting to the countershaft. This lever is always within easy reach of the operator in whatever position the arm may be.

By means of a friction device the spindle can be made to slip at any desired resistance, and the amount of resistance at

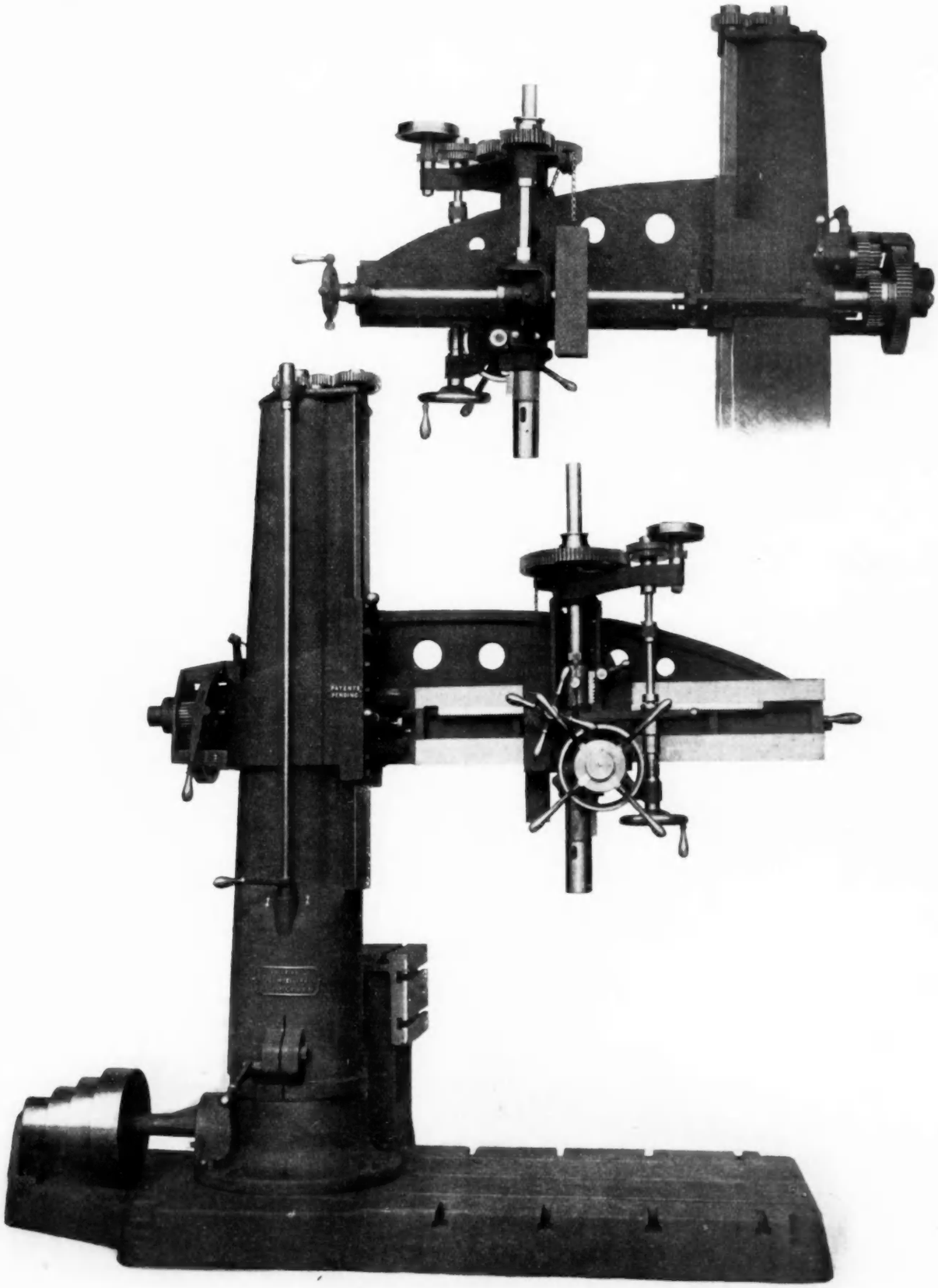

FIG. 1. NEW RADIAL DRILLING MACHINE.

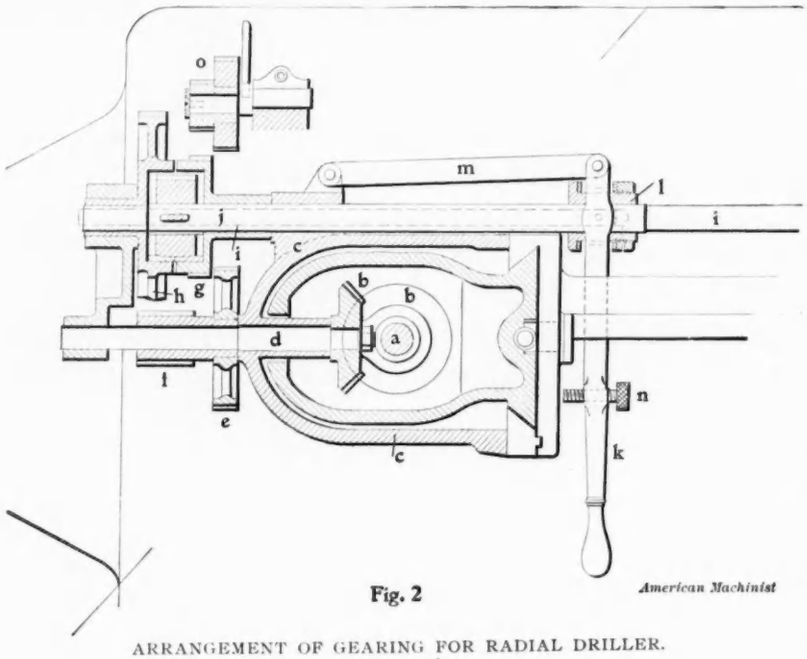

Fig. 2

ARRANGEMENT OF GEARING FOR RADIAL DRILLER.

which slipping will take place is regulatable by means of a knurled-head screw, which passes through the operating lever before referred to, and thus when using relatively light taps, or when tapping to the bottom of a hole, danger of breaking taps can be much reduced.

The quick return is by means of the four levers shown in front of the feed worm-wheel, and either one of these levers which the operator may happen to select can be used to operate the clutch.

The feed is engaged or disengaged by a touch of the knob in front of the operator and the speed changed by shifting the knurled collar on the vertical feed rod, all while the drill is running.

The spindle is graduated to indicate the depth of the drilling, and there is also an adjustable automatic feed stop.

The arm is fitted to flat surfaces on the column, and is raised or lowered by power. To the arm is fitted a bracket, which extends around the column, as shown, and supports at the rear the back gears which are of the friction type, and are arranged as shown in Fig. 2, in which figure the operating lever before referred to is indicated by the letter *k*.

In this drawing *a* is the central shaft in the column, which drives the mitres *b b* carried in the bracket *c*. On the short shaft *d* slides the compound gear *e f*, meshing with gears *g h*. Pinion *f* has a long face, so that *e* and *g* can be disengaged while *f* stays in gear with *h*; *g* and *h* run loose on the shaft *i*, but can be alternately clutched to it by the double friction clutch shown. The friction cone is surrounded by two split rings, kept from turning by a feather fixed in the cone. The friction rings work loose in their recesses, but expand and clutch the wheels to the cone and shaft, when the cone is drawn into them. The friction cone is operated by the lever *k* by means of the rod *j* in the shank *i*, link *m* and collars *l*, as will be seen from the drawing. Screw *n* on the operating lever serves to regulate the grip of the clutch in the wheel *h*, and as this is the right-hand, slow motion of the spindle it is of great value in light and bottom tapping.

To reverse the motion on the fast speed gear *e* is shifted out of mesh with *g*, as shown on the drawing, and the compound intermediate gear *o*, running on an eccentric stud, is thrown between the two.

Shafts *d* and *i* are not in the same horizontal plane and therefore the gears could not be shown in gear.

In connection with this view Fig. 3 makes the driving mechanism very plain, and this latter view also shows how the column is arranged and the roller bearing upon which the weight of the rotating portion of the column is borne.

This roller bearing has each alternate roller slightly smaller in diameter, so that the motions of the rollers are as indicated by the arrows at the left of Fig. 3, and friction between adjacent surfaces of the rollers is thus practically eliminated.

Smaller machines are provided with ta-

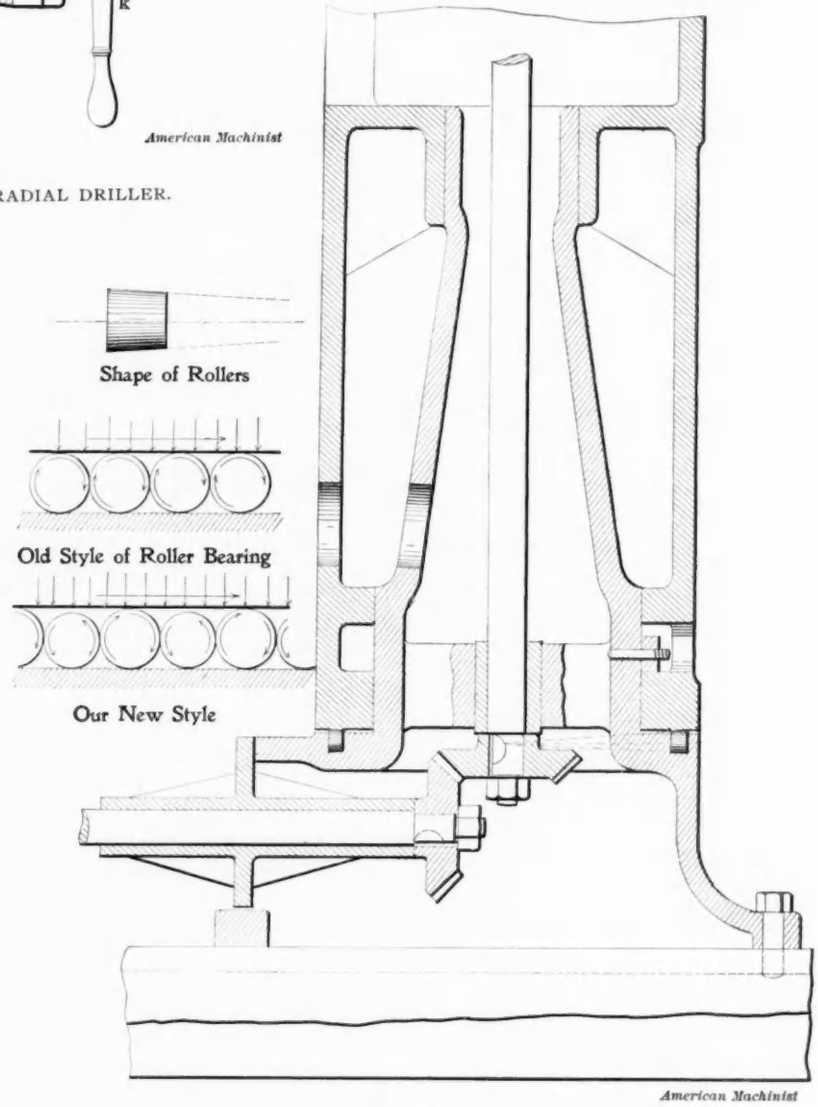

Fig. 3

SECTION OF COLUMN SHOWING ROLLER BEARING.

ble on swinging arm. The machine is built by Dreses, Mueller & Co., Cincinnati, Ohio.

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Letters from Practical Men.

Percentages of Efficiency.

Editor American Machinist:

The question of what should constitute a standard method of expressing engine efficiencies, recently raised in your columns by "Tecumseh Swift," is well worthy of discussion. He has fully stated the difficulty and enumerated the multiplicity of methods now in use. I will confine myself to suggesting a way out—the one, in fact, which has survived in my personal experience as the fittest for practical use.

There are just four quantities of energy visible in any heat engine which are of importance to the engineer, viz.: (*a*) the quantity of heat given to the engine; (*b*) the quantity which it ought to convert into indicated power under the actual conditions of operation were it a perfect engine in all that precedes the movement of the piston, *i. e.*, if it involved no thermal losses from radiation, etc., or fluid-mechanical losses from port friction, imperfect valve motion, etc.; (*c*) the quantity of indicated power which it actually does develop in the cylinder; and (*d*) the power actually available on the belt.

Comparison of these four quantities gives four distinct efficiencies which I designate as follows:

(1) $a \div b =$ the theoretic efficiency;

(2) $b \div c =$ the cylinder efficiency;

(3) $c \div d =$ the mechanical efficiency;

(4) $a \div d =$ the thermodynamic efficiency.

Each of these efficiencies is of distinct value for distinct purposes to a distinct class of men. Thus:

(1) is the efficiency of Type and Environment, and is useful chiefly to the student in comparing the possibilities and responsibilities of different classes of our engine servants.

(2) is the efficiency of cylinder-design and valve-motion, and is of use in measuring the skill with which the designer has made the most of these possibilities and responsibilities.

(3) is the efficiency of the machine, and is useful to the machinist in his efforts to minimize friction.

(4) is the efficiency of the prime mover, and shows the consumer what he gets for what he pays.

Now that we have reached the days of constant comparison of steam engine with gas engine or hot-air engine, of high pressure with low, and quadruple compounding with the Rockwood system, these figures will be found to carry one clear-headedly through all reefs and shoals. Thus, interesting facts are that as we pass from simple non-condensing to triple-expansion condensing engines the value of (1) rises very rapidly, while (2) runs down hill, or that the value of (2) for steam and gas engines is practically the same, although the gas engine has a much higher total thermodynamic efficiency, or (4).

For student work I use one more efficiency, which would be of great help to most designers in aid of clear thought. This I call the cycle efficiency, and is a comparison of *a* with the always greater amount of energy available from a Carnot or Stirling cycle operating between the same temperature limits. But for general use it has little value.

If all engine tests stated their results in these four or five figures the information given would be much more complete than is now afforded by whole columns of data.

SIDNEY A. REEVE.

Worcester, Mass.

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The De Laval Steam Turbine.

Editor American Machinist:

Being a subscriber to your valued paper, I have noticed an article in issue of September 30, 1897, written by Mr. John E. Sweet, and containing a short description of the De Laval steam turbine.

I find in the said article a few points requiring to be corrected, and I would feel obliged if you would kindly bring my remarks under the notice of your readers.

Mr. S. says that the De Laval turbine must work condensing. In fact there is no obstacle to its working non-condensing more than in the case of the piston engine, *i. e.*, the steam consumption increases. That nearly all the turbines working at the Exhibition of Stockholm were condensing was simply owing to the fact that there was easy access to cooling water, and so the machinery was arranged to work with the best economy possible.

Of all the De Laval turbines now working in practice—upward of 1,100—the sizes below 50 H.-P. are mostly running non-condensing.

The turbines working in connection with the De Laval high pressure boiler must necessarily be arranged condensing when the feed water contains salt or other impurities; the boiler requiring pure feed water.

Mr. S. mentions that the life of the turbine wheel is limited to two years on account of the steam jet eating the buckets away, and that after this the turbine requires an expensive repair. In the first place, when dry steam is employed, the wear of the buckets is insignificant, and may be compared to the wear of the piston rings in the ordinary steam engine.

Secondly, the repair when required, consists simply in renewing the buckets in the turbine wheel—a process easily effected by any mechanic. The cost of a set of buckets for a turbine of 100 horsepower is at present about $20.

The expanding nozzle is not abandoned, and will not be, because such an alteration would increase the steam consumption considerably.

If Prof. Sweet had found time to pay a visit to the De Laval Turbine Works, while he was in Stockholm, I should have been delighted to make his acquaintance, and would with the greatest of pleasure have placed myself at his disposal for all detailed information concerning our machines.

G. OSCAR OLSSON.

Engineer in the employment of the De Laval Steam Turbine Works, Stockholm, Sweden.

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Editor American Machinist:

I can only justify myself in regard to what I wrote about the De Laval turbine by saying that I assumed in writing from Stockholm that what I had written from Belgium had been read in connection with it. As I was told at Liege that the engine ran on 20 pounds of steam condensing and took 50 pounds non-condensing, I knew, of course, that the engine would run non-condensing, but assumed that, owing to the difference in steam consumption, no one would run it that way.

As to the expanding nozzle, Mr. Halstrom said he had understood they did not use it, and I suppose I was the more ready to believe that from consideration of how the steam would have to hustle to get an extra impulse from expansion after leaving a nozzle at something like 2,000 pounds pressure.

As to visiting the De Laval, the Atlas and other shops of Sweden, it is likely that had I been well I should have taken steps to have done so; but I was all the time looking for excuses for not going into shops, and I expect now if I had looked for excuses for not saying anything about things which I could not verify, it would have been quite as well. There is this by way of compensation, however, that I have unintentionally misrepresented things just enough it seems to bring from the injured parties the facts which we might not have obtained otherwise; so my humiliation may be balanced by the gain to your readers.

JOHN E. SWEET.

Syracuse, N. Y.

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Cracks in Boiler Sheets.

Owing mainly to the unavoidable confusion attending a change in printing arrangements, the illustrations for the letters of Messrs. John D. Riggs and George M. Taylor on "Cracks in Boiler Sheets," published last week, were inad-

vertently omitted. In order to make them intelligible we repeat the letters with the illustrations.

Editor American Machinist:

Some cases of boiler practice that have come under my notice would seem to throw some light on a possible cause of weakness in the boiler, which you speak of in your issue of December 16 as having exploded at Rochester, N. Y. One of these cases was that of a pressure tank, containing air and cold water, about 50 inches diameter, with heads as shown in Fig. 1, and ½ inch thick. The heads were not braced in any way, all seams were double riveted and the workmanship on the job was probably above the average, although not of the best. After being in use about two weeks one of the heads blew out, tearing the solid metal at *a*, Fig. 1, and not at the first row of rivets, where about one-third of the sheet was cut away by the rivet holes. The pressure, as shown by gage shortly before the failure, was about 200 pounds, which would make a tensile stress of about 5,500 pounds per square inch of the fractured section. The fracture at *a* ran around the head from a quarter of an inch to an inch from where the short curvature begins next the shell. The short curve was about 2 inches radius and the heads were machine flanged.

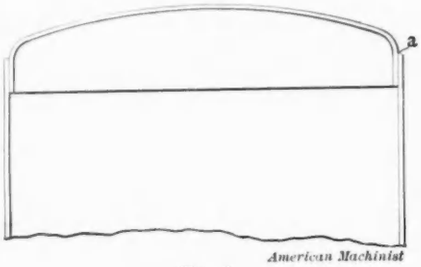

Fig. 1

WHERE THE HEAD GAVE OUT.

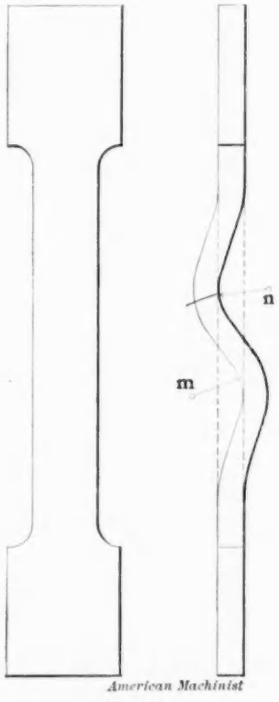

Fig. 2

SUGGESTION FOR TESTING BOILER STEEL.

It is, I think, quite generally known, to blacksmiths and others, that if a bar or plate is bent pretty short it is very liable to crack in the bend if straightened out; in fact much more liable to break if straightened than if bent more. In the tank mentioned above the heads bulged out at the center, and this brought a reverse bending strain on the part at *a*, Fig. 1.

It is easy enough to find boiler plate for sale that will stand a tensile strain of 65,000 pounds per square inch, or which may be bent double and hammered down without cracking; but who has ever tested a piece for tensile strength at the point where it has been bent double? Yet in a boiler the plates must be bent and tortured more or less with the sledge before they can hold steam.

In testing specimens of boiler plate it might be well to bend a test specimen to the form shown in Fig. 4, and test it for tensile strength along with the standard straight piece. While any plate is weakened by this bending, the one that is weakened least would seem the most desirable.

JOHN D. RIGGS.

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Editor American Machinist:

In your issue of December 16 you have an article on a boiler explosion which took place at Rochester, N. Y. On November 3 a sawmill boiler in this city exploded under exactly similar conditions. I was called as an expert witness on this case, and on making an examination of the remains of the boiler I found a crack over 4 feet long in one of the plates extending nearly through, having not over 1-16 inch of sound metal in the thinnest part.

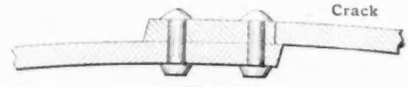

Fig. 1

Fig. 2 American Machinist

THE USUAL AND THE BETTER WAY.

This crack started about midway between the edge of the rivets and the edge of the lap in a double riveted lap joint longitudinal seam, well up out of the fire and covered by brickwork.

My theory as to the cause of that crack is different from that of the other witnesses on the case, and also from that of Mr. Allen, of the Boiler Insurance Company, and I would like to have an expression of opinion from you or some of your readers.

I inclose two sketches to illustrate my meaning. No. 1 shows a lap joint as usually constructed. No. 2 shows the same joint as it should be, and is made by some boilermakers. My theory is that when internal pressure is applied to the shell it will assume the shape shown in No. 2, unless prevented from doing so by some other force acting against it, which in this case is the resistance of the plate to flexure. With the pressure fluctuating from 75 to 100 pounds, consider that the plate at this point of fracture (see Fig. 1) is subject to a constant bending action, which continues until the crack begins to develop. As years pass on the crack increases in depth, until there is not sufficient strength to withstand the pressure, and the explosion occurs.

I have seen boilers with lap joints constructed as in sketch No. 2, but they are not common in this part of the world, and in my estimation the only proper construction of the longitudinal seams of boilers is the double butt strap. In conclusion, let me say that I am writing this letter for the purpose of getting other people's opinions on this subject. No stone should be left unturned to make the thousands who work about boilers reasonably sure that when they go to work in the morning they will not be brought back before night in the ambulance mangled out of all resemblance to human beings.

GEO. M. TAYLOR.

Vancouver, B. C.

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Compressed Air Explosions.

Editor American Machinist:

I notice in the "American Machinist" of December 30 an article by Frank Richards upon "Compressed Air Explosions," which refers to some remarks made by me in discussion of Mr. Dickie's paper on the "Auxiliary Engines and Transmission of Power on Naval Vessels." Mr. Richards speaks of the danger of explosions such as I referred to as "not possible without the grossest negligence," and also says that there is "not the slightest occasion of alarm from this source." I had no intention of playing the part of an alarmist, but at the same time I do not believe in ignoring dangers which have certainly proved to be very real in numbers of well authenticated cases. I inclose a notice of several such explosions written by myself for the "Engineering Magazine" (October, 1897), and in regard to Mr. Richards' reflections upon the construction of the com-

pressors I may call attention to the fact that these occurred with such well-known machines as those of Burckhardt and Riedler, certainly not cheap or of inferior construction.

There is nothing whatever surprising about the ignition of vaporized oil by the heat of compression, a number of petroleum motors depending solely upon this source of ignition for their action. If Mr. Richards wishes further information upon this subject I can refer him to the issues of "Glückauf" for June 26, and especially for October 9, 1897, in which he will find a full account and list of many of such explosions, together with discussions as to the causes and disastrous results. HENRY HARRISON SUPLEE.

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Shaper Attachment for Rod Brasses.

Editor American Machinist:

I suppose there are many persons who regard the milling machine as the only proper place for machinery connecting rod brasses. Whether this be true or not, it frequently happens that such work must be done on a planer, or shaper, and as a rule the ordinary platen vise, or angle plate, serves for chucking such work. Having had a good deal to do in this line, a special attachment was made which greatly facilitated the work, and it may be of interest to some of your readers if a description of the fixture be given here. Figs. 1 and 2 represented a front and side elevation, as seen when attached to a shaper platen. The box to be worked upon is shown at *a*. It is securely held to the turret *d* by means of the stud *c*. The sides of the box are first trued off or brought to size. This renders the work less liable to slip should the cutting be heavy. The thread on the stud is finer than usual, in order that its holding power may be increased. Any machinist will at once understand the manipulation of the device. It is obvious that the stop *e* may be made to hold the turret in any desired position, depending on the graduations *o*, *o*, *o* in its periphery. It is also held firmly in position when once set by means of the handled nut *f*. If desirable, the box may be bored and faced on sides before planing, and whether it be centrally placed on the stud or not will make no difference in the accuracy of the work. If care be taken in seeing that the axis of the turret is exactly square with the line of movement of the cutting tool, the work will not be wanting in accuracy, at least, so far as uniformity in thickness of the flanges is concerned. I have found it best, however, to plane the edges of the flanges and the four sides of the box first before cutting down the flanges. Uniform width, to suit the strap, may best be secured by means of a tool like Fig. 3. When once properly set this tool may finish all four sides, having no movement except the vertical feed. The facilities afforded by the turret for turning the box render such a course possible, when the slower operations of chucking would not.

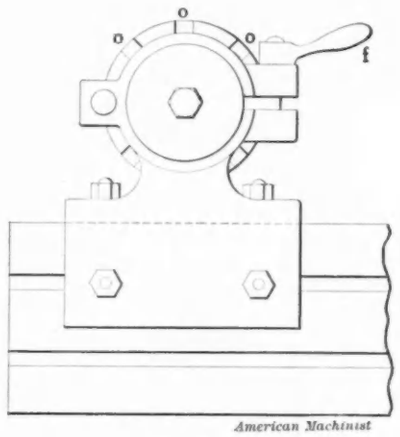

Fig. 1

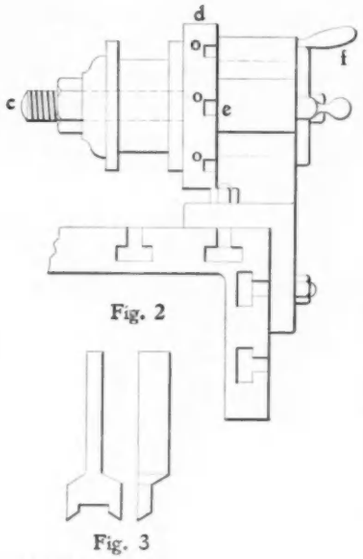

Fig. 2

Fig. 3

SHAPER ATTACHMENT FOR ROD BRASSES.

QUIRK.

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Cooling Water by Re-expanded Air.

Editor American Machinist:

R. E. Chandler's difficulty (your issue of December 30, 1897) is explicable as follows:

When liquid ammonia, ether, etc., is expanded by release of pressure in a refrigerating machine it produces intense cold because it can no longer exist as a liquid and it cannot become a vapor without absorbing a large amount of heat energy in separating its molecules against their own cohesion. The energy thus absorbed is called "disgregation work" because it scatters the *con*gregation of molecules.

Compressed air when released can exert little similar absorption of energy because its molecules, being gaseous, have little cohesion to resist separation. (The word "little" here means "none" in an engineering sense.) Hence the heat energy has to be absorbed in some other way, if cooling is to be effected. The readiest opportunity is in performing external work, and so all air refrigerating machines expand the air in a working cylinder whose power helps to drive the machine. The exhaust from this cylinder, as from the air motor, is very cold, whereas air expanded through a valve is only slightly so.

It *is* slightly so because air molecules have a slight cohesion, but so slight that no practical use has ever been made of the phenomenon until Dr. Linde and Mr. Thomson brought out their processes for the continuous liquefaction of air. (See "The Engineer," November 13, 1896, p. 485; March 19, 1897, p. 294, and other communications in the same volumes.) Mr. Chandler will find in these references formulæ which will explain to him his failure. OHIO.

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Adjustment of Screw Machine Threading Dies.

Editor American Machinist:

I would like to call the attention of the readers of the "American Machinist" to a better way of holding spring dies to size than a clamp collar or a collar with set screws on each prong of the die. If a taper thread be cut on the outside of the die and a ring made about ¼ inch wide and of suitable diameter, knurled on the outside and hole bored and threaded taper to match the outside of the die and large enough, so when the die is down to size the ring will be about ¼ inch from ends of prongs, it will be found that the die will cut smoother threads and last about twice as long without sharpening as the old style clamp collar because every prong is cutting, and when it is to be adjusted it can be done by simply turning the ring, adjusting each prong alike. It is better to have two rings, one bored and threaded larger than the other, so when the die gets ground up to the first, or small, ring the larger one may be substituted and the die worn to the last threads. ALEXANDER CARLEY.

Syracuse, N. Y.

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The number of locomotives in Russia at the commencement of 1897 was 8,123. Of these about one-eighth were compound engines. Nearly one-half of the engines were built in Russia, and of the whole number 45 per cent. were built before 1880. The fuel used on 40 per cent. of the locomotives was coal, while 32 per cent. of the engines used petroleum and 28 per cent. wood.

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Foreign Trade in Machinery.

On the 25th of this month the National Association of Manufacturers will meet in this city, and it is certain that the subject of our rapidly growing foreign trade in manufactured articles will command a large share of attention. In this connection it seems proper that we should call attention to a few facts and suggest a few lines of thought directly connected with the export of American machinery.

This being a technical journal, it is not expected of us to discuss political or economic matters, but so far as the export of machinery is concerned, it is our business to know the facts, and the wise man does not ignore facts, but considers them, and, if need be, modifies his previously conceived ideas in accordance with them.

The leading facts to which we wish to call attention are as follows: We have had in the past, and shall probably have in the future, periods of commercial depression during which a widely diffused foreign trade will be especially valuable to manufacturers of machinery and to their employés.

The period of depression following the panic of 1873 and lasting six years was more disastrous to machinery manufacturers generally than the more recent period following the money panic of 1893, mainly because during the first named period our exports of machinery were very small; whereas, during the past few years they have been very large.

The cost of the materials out of which machinery is made is now generally lower here than elsewhere; so much lower that these materials are being sold in England and on the Continent at lower prices than can be met by foreign producers of the same materials, freights being, of course, added to our costs of production.

Our labor employed in machine building establishments, though usually (not always) receiving higher wages per day, is generally cheaper when its product is considered, because it is true, as we are in the habit of saying, that our intelligent, highly paid and ambition-spurred labor is the most efficient in the world.

Machine tools in which the labor costs far exceed the costs for material have been, and are now, going abroad in large numbers, and are selling in foreign countries at prices which cannot be met by foreign builders for the same classes of machinery—a fact which is acknowledged by foreign machinery builders.

As much as 90 per cent. of the entire product of some of our American machine shops has within the past few years been going abroad.

Many of our American machine building establishments have been sending a large proportion of their products to Germany, where they pay an import duty and successfully compete with the products of a nation whose competition England feels and dreads more than that of any other European country.

Imports of American machine tools into Germany are so large that some of the manufacturers of similar machines there are demanding of their government increased import duties to protect them from what they regard as the ruinous competition of low cost American machinery.

Their argument in favor of such duties is strengthened by the fact that high and still higher import duties are laid by us upon such machinery, which everyday experience demonstrates we can and do produce at lower cost than they can possibly produce it.

The teachings of all accredited political economists, and of all human experience as well, clearly show that international trade is and must be an exchange of commodities, *i. e.*, of values produced by the application of labor and capital to the materials supplied by nature.

When we say to a foreign nation, "We want you to buy our machinery, but we will accept nothing you produce in exchange for it"; when we take measures to increase our exports and to exclude imports we are attempting to do two diametrically opposed things, and are setting at defiance the laws of trade.

Any restriction applied to imports must necessarily act eventually to restrict exports equally.

Manufacturers of machinery in America who are not organized in a trust or its equivalent have to meet decidedly the fiercest competition that is to be found to-day upon the face of the earth; and it is only by the most strenuous efforts that the majority of such manufacturers can secure a fair return on their capital and for their services as managers.

This competition comes from within, and has undoubtedly been stimulated by our tariff system. In fact that has been declared to be one of the objects of that system. Trusts and equivalent organizations enable manufacturers to avoid this ruinous competition, but both reason and experience show that trusts cannot permanently endure.

The demonstration that American manufacturers can meet the competition of foreign manufacturers in many lines will be worth more to us than the direct returns for the goods exported during the past three years, if only this knowledge of the possession of power is wisely used, and if the advantage to be gained by it is not thrown away or nullified by actions controlled by ideas growing out of dead and gone conditions.

Much is made of the fact that "we have no carrying trade," and that our exports must pay to foreign ship owners the cost of their transportation. There are those who seem to believe that this is necessarily a serious handicap to our foreign trade and that no remedy for this condition can be found until by subsidies we establish and maintain lines of ocean transportation.

The reason given for this is that foreigners will work as sailors at lower wages than Americans will, and that foreign ships are subsidized. It is, however, clearly the fact that if foreigners would work as sailors for nothing and board themselves, our exportations of manufactured goods would be facilitated; *i. e.*, we could lay them down in foreign ports at a lower cost and with a still larger margin for successful competition. If American labor and capital refuse to go into shipping it is proof conclusive that in railroads or otherwise they can do better, and if a bounty were to be paid to induce them to go into it, that bounty would have to be paid out of the products of American labor and capital, because there is no other source from which it could be collected, and this payment would constitute an element of cost inevitably to be added to the total cost of

production of goods, whether for export or for home consumption.

The vast majority of ocean freights are carried in steamers which are not subsidized and receive no government aid whatever, and only about 4 per cent. of Great Britain's merchant marine receives from the government any subsidy or other form of bounty.

It is not the part of wisdom to allow oneself to be blinded to the existence of plain facts because those facts do not square with one's previously conceived notions. Facts are stubborn things, and the laws of trade cannot be perverted to the advantage of those who ignore and defy them.

We cannot permanently do business with foreigners on a basis of "retaliation" or of "hostile tariffs," but must do busines abroad, if at all, on a basis of mutual benefits; which is the only basis upon which trade anywhere with any people can be long continued.

If, now, it be true, as Americans of all shades of political opinions frequently declare, and as we ourselves believe, that our American skilled labor is the most efficient labor in the world, and if it be also true that we buy the materials out of which machinery is made at lower prices than they can be supplied to machinery builders in other countries, of what actual effect is a protective tariff on machinery other than to belie these claims, aggravate foreign machinery builders and materially assist them in whatever efforts they may make to secure the enactment of "hostile tariffs" directed against our machinery builders?

It is our desire to see American machinery builders prosper and their employés earning good wages every day and all the time. They deserve this good fortune. We believe the way toward this is by greater exports of machinery, and if machinery is to be exported we must accept goods in return for it, and must have less to say about the products of "foreign pauper labor."

All indications point to a general re-equipment of British engineering establishments within the next five years. It is the business of American machine tool builders to consider carefully and dispassionately how they may best go about getting the larger share of this business.

Having thus plainly spoken our convictions as to what we believe concerning a matter of vital importance to American machinery builders and their workmen, we do not propose to discuss it further—we have other things to attend to; but we commend this as a subject for serious thought; for, whether one is a Democrat and calls it free trade, or a Republican and calls it reciprocity, it is certain that the interests of American machinery builders demand increased trade relations with other countries, and that obstructions to such trade shall be removed.

We believe that most of those American tool builders who have carefully studied foreign business, especially those who have gone abroad to do their studying, will agree that what we have written above is substantially true. Those who have not given any study to the matter will be wise to do so. We are not "talking politics," but are stating plain facts as they actually exist—facts which will certainly, in the end, force themselves upon the attention of all American machinery builders.

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Mention of Patents.

There appears in this issue an illustration of a very interesting machine, the construction and method of operation of which we show fully, and in sending us drawings for this machine the manufacturers thereof specially requested that we should mention that it is patented, they supposing that such mention would in some way protect them from the encroachments of those whom they term "copyists."

We do not mention the matter of patents in the description of this machine, because we do not believe that the mention of patents with such descriptions is usually any benefit or any protection whatever. The fact is that most of the machines we illustrate and describe, and which are regularly manufactured by those who are in the business, are more or less protected by patents. We do not always know whether they are patented at all or not, and when we do know that patents have been taken out on a machine we usually do not know just what features these patents refer to or cover. In some cases, however, where machines have been patented we are not informed that such is the case, and could not, therefore, say whether they are patented or not. To mention patents in some cases and omit such mention in others would be misleading. This being the case, we uniformly avoid the mention of patents in connection with our descriptions, and we assume that machinery men understand perfectly well that where a machine is placed upon the market by a manufacturer it is advisable for those who may think of building it or of making use of any of its features to first examine into the matter of patents. The law requires a manufacturer of a patented article to mark it "patented"; but a manufacturer is not responsible for what we say about his machine and the law does not apply to our descriptions.

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We stated in our issue of January 6 that the Lane & Bodley Company had been awarded the contract for a new pumping plant for the Cincinnati water works, and that there would be a contest regarding the matter, which might be carried into the courts. We are now informed by the Lane & Bodley Company that there will be no such contest, and that the contract has been signed, the bonds given, and the final plans gotten under way. This is the largest contract ever let by the city of Cincinnati.

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Professor Brown, at a recent meeting of the Auckland Institute, New Zealand, gave the results of some experiments in heat insulation. The materials tried were charcoal and pumice. Each was used in three sizes, which were, approximately, a quarter of an inch, a sixteenth of an inch and powder. The escape of heat was least with the coarsest grade of pumice and greatest with the powdered charcoal. Charcoal is more liable than the pumice to absorb moisture, and also to absorb organic substances, so that pumice is generally to be preferred.

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It is said that some surprising results have been realized at the Catasauqua, Pa., blast furnaces, in making pig iron from the ore produced by the Edison magnetic separating processes. It was found that the pigs could not be broken by the usual means, that they were, in fact, malleable iron, and the chemists, who are still busily investigating the matter, are talking of the discovery of a new metal.

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Inquiries for Machinery.

Those who make, or who may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

23—From India for a hand machine for engraving on brass and steel, such as words, flowers, figures, etc. Also machine for similar engraving on silver, gold and on stone for seals.

24—From India for machinery to cut diamonds, rubies, precious stones, etc.

25—For a machine for filling a chemical preparation into small cardboard boxes.

26—For a motor cycle capable of taking place of horse and buggy on dirt roads, and reasonable in price.

27—A small motor to work by gasoline and suitable for a light carriage.

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Mr. P. W. Gates, chairman of the Committee on Patents and Patent Litigation of the National Association of Manufacturers, sends us a circular of information which has been issued by that committee and which refers to the change in the patent laws and methods of procedure which are to be discussed. This circular contains communications on the various subjects from a large

number of persons interested, and the committee offers to send this circular to anyone interested, and invites further discussion upon it previous to the meeting, which takes place in this city on the 25th inst. The address of the association is 1743 North Fourth street, Philadelphia.

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Personal.

Assistant Engineer G. H. Shepard, U. S. N., has been retired.

Passed Assistant Engineer J. S. McKean, U. S. N., has been ordered to the Navy Yard at Norfolk.

Chief Engineer A. C. Engard, U. S. N., is detached from the "Richmond" and ordered to the "Baltimore."

Chief Engineer L. J. Allen, U. S. N., it detached from the Continental Iron Works and ordered to the Union Iron Works.

Mr. H. L. Kinsley, who was with the Hopedale Machine Screw Company fifteen years as salesman and superintendent, has severed his connection with it.

The Navy Department has been informed of the breaking down of Absalom Kirby, Chief Engineer of the United States ship "Baltimore," now at Honolulu. The officer has been invalided home.

Mr. Seaton M. Scott, Member A. S. M. E., and late mechanical engineer of the Kelly & Jones Company, Greensburg, Pa., has opened an office at 123 Liberty street, New York city, as a consulting mechanical engineer.

Mr. Oluf Tyberg, who formerly had an office as consulting engineer at 132 Nassau street, New York, has removed his office to 576 West Broadway, New York, where he will be identified with the Century Machine Company.

Mr. A. A. Avery, former superintendent of the Shelby Steel Tube Company, and a short time with the Ellwood Weldless Tube Company, has been appointed general superintendent of Factory "B" of the Shelby Steel Tube Company, Ellwood City, Pa.

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Obituary.

David Hall, of Hubbard, Ohio, a pioneer iron manufacturer of the Mahoning Valley, was found dead in his barn on January 9.

Mr. Burr K. Field, vice-president of the Berlin Iron Bridge Company, of East Berlin, Conn., died at his home in that city on the 12th inst., in the forty-first year of his age.

Joseph J. Boyce, president of the Long Island Machine Construction Company; of Long Island City, died on the 13th inst.

Benjamin Butterworth, Commissioner of Patents, died on the 16th inst. In 1883 Mr. Butterworth was appointed chief of the Patent Office by President Arthur. He was reappointed by President McKinley.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(2) J. O. B., Anderson, Ind., asks: Can you give me a rule for finding the weight of a fly-wheel for an engine 18x24 inches at 135 revolutions per minute, boiler pressure 90 pounds? A.—The practice of engine builders varies so widely regarding fly-wheels that there can be said to be no rigid rule applicable to the case. Professor Barr, in his paper entitled "Current Practice in Engine Proportions," gives the following for the weight of the fly-wheel rim:

$$\left.\begin{array}{l}\text{Mean} \ldots\ldots 1{,}200{,}000{,}000{,}000 \\ \text{Maximum} \ldots 2{,}000{,}000{,}000{,}000 \\ \text{Minimum} \ldots\ 650{,}000{,}000{,}000\end{array}\right\} \times \frac{H\,P}{D^2 \times N^3}$$

Here $H\,P$ is the nominal horse-power, D the diameter of the rim in inches, and N the number of revolutions per minute. It will be noticed that the maximum result by this formula will be more than three times as large as the minimum. Taking the mean and assuming the nominal horse-power of the engine to be 150 and the diameter of the rim of the wheel 10 feet, we have:

$$1{,}200{,}000{,}000{,}000 \times \frac{150}{120^2 \times 135^3} = 5{,}080 \text{ lbs.}$$

For other diameters of rim the weight will, of course, be inversely as the diameter.

(3) B.W J., Dover, N. J., asks: Will you kindly tell me the power of the following belt, and explain the formula in plain figures? Driving pulleys, 16 inches diameter by 16 inches face and 490 revolutions per minute. Driven pulley, 72 inches diameter, belt double, 15 inches wide and total length 71′ 8″. Contact of belt on small pulleys 2′ 3″, on large pulley 10′ 3″; total length of belt 71′ 8″, and it makes 30 passes or turns per minute. A.—The data here given are not of a kind that it is pleasant, or, indeed, even altogether safe, to have anything to do with, as they are evidently incorrect. The speed of the belt as given is 100 feet per minute more than that of the periphery of the driving pulley. The contact of the belt on the small pulley is more than a half of the periphery, which is impossible, unless there were an idle pulley to lead it around farther; and then, or even without that, the contact around the large pulley is not as great as it should be. The driving power of a belt depends upon its tension, and also, more than is generally allowed for, upon the adhesive condition of both belt and pulley surfaces. It is quite customary to estimate the power transmitted by a belt by the number of square feet of belt surface that passes over the pulleys per minute, and for double belts 40 square feet is a common allowance. In the present case the diameter of the driving pulley being 1 1-3 feet, and the revolutions 490, the linear feet of travel will be $1\ 1\text{-}3 \times 3.1416 \times 490 = 2052$ feet. Then the belt being 1¼ feet wide the number of square feet of belt per minute will be $2052 \times 1\frac{1}{4} = 2565$ square feet, and then $2565 \div 40 = 64$ horse-power. The above practice can be safely followed only when there is not a great difference in the relative diameters of the two pulleys. When there is much difference allowance must be made for the smaller arc of contact on the smaller pulley. The result above we may assume to be for a contact of 180 degrees, or half way round. For shorter contacts the result may be diminished in direct proportion to the actual angle. If the angle of contact was 160 degrees then 180 : 160 : : 64 : 57 horse-power. The method here followed is a rough and ready one; but more exact methods would not give any more reliable results in ordinary belting practice.

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A Co-operative City Electric Lighting Plant.

The Gisholt Machine Company, of Madison, Wis., which company is well known to our readers, has made a proposition to the city of Madison regarding a co-operative electric light plant. This proposition is in refreshing contrast to the too common wire-pulling and underhanded methods pursued in such matters, and to give an idea of its tenor we quote from the proposition written by Mr. J. A. Johnson, president of the Gisholt Company, as follows:

"Believing that municipalities should have a fair share of the profits of such public utilities as make use of the streets, and believing further that private enterprise can conduct these utilities more efficiently and more economically than is possible for the municipality, the Gisholt Machine Company desires to make a proposition for lighting the streets of the city by electricity and for furnishing electricity for any other city purpose on the basis herein briefly outlined:

"The Gisholt Company will install a suitable plant for the purpose, or have a separate company organized for it as it may think best, and will furnish the city with such amount of electricity for lighting and other purposes as the city may from time to time require, at a rate not exceeding that now being paid, and the amount of electricity required not being less. The company will keep a separate itemized and accurate account of the cost of the investment in the plant, and of all expenses connected therewith and of maintaining the same and conducting the business, which shall at all times be open to the examination of the city authorities.

"After the actually invested capital, without any injection of so-called "water" or fictitious capital whatever, has received 3 per cent. semi-annual dividends as interest or profits, the surplus earnings above the 3 per cent. shall be equally divided between the city and the company. It must be understood that a reserve may be required for repairs, betterments and extensions, so that the surplus earnings above the 3 per cent. will not always be immediately divided. But the shareholders will receive no greater benefit from this reserve than will the

city. The proposition is to divide all net gains above the 3 per cent. semi-annual dividends equally between the parties.

"The contract between the company and the city to continue thirty years. At the end of that time the whole plant to be sold to the best advantage, when it may be purchased either by the city, the company or any other party, unless an extension of the old contract or a new one is mutually agreed upon by the parties. The invested capital shall be refunded to the shareholders, and the overplus be divided equally between the city and the company.

"It is, of course, understood that the company will furnish electricity to other consumers, but the city will share in the profits on this business the same as on its own.

"That the best possible and most economical plant may be erected for the purpose, the company reserves the period of three years in which to install it and have it ready. It is, however, expected to have it ready within two years. The company believes that the cost of electricity will in the future be considerably reduced, and that the city should provide for receiving the benefit of a fair share of such reduction. The company believes that such reduction has been fairly provided for in this proposition.

"If at any time any dispute should arise between the city and the company, the matter in difference to be left to three arbitrators, one to be chosen by the city, one by the company and the third to be selected by the two, and if they cannot agree, the third to be selected by the judge of the Circuit Court. The decision of the arbitrators to be final.

"Should the company at any time either not earn the 3 per cent. semi-annual dividend or by reason of improvements or betterments its payment should be deferred, interest at 6 per cent. payable annually to be paid on the amounts so deferred, which shall be taken out of the future profits."

So far as we are aware, this proposition is original in character. We hope it will be tried, and feel sure the outcome of the trial will be watched with considerable interest.

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Foreign News Notes.

The most prominent of the agricultural schools in Italy is that of Portici, about six miles from Naples, which has been in existence for twenty-four years. Upon these agricultural colleges depend, in a large measure, the introduction of agricultural machinery. At the college named above an exhibition of such machinery is kept constantly on hand.

There is a need for decorticating machinery in Paraguay, where there are a great many plants running to waste for lack of such machinery; in fact, the cultivation of ramie is being abandoned on that account.

Servia, and especially Belgrade, reports a vast field for importations of machinery. Zinc plates are principally imported from Germany, and are sold in sheets 2 meters long by 65, 80 and 100 centimeters broad, at a cost of $7.29 per 100 kilogrammes. There would be a good field in that country for hardware, machinery, firearms, scientific instruments and sewing and knitting machines. At the present time Germany has the monopoly of all these articles; for instance, Austrian and German files, either flat or circular, are largely used by smiths, the most common size employed being 13¾ inches long. The Austrian file is supplied at a cost of 25 cents and the German at 18 cents. There is a small three-cornered file on the market of French make, sold in Belgrade at a cost of 45 cents per dozen.

The importation of machinery, implements and arms in 1895 was valued at $163,757, of which Austria claimed $101,301 as her share; $22,278 of that import value was represented in scientific instruments and $31,905 represented the importations of firearms, chiefly revolvers.

An amount of personal work will be required to secure this market, for the reason that Servians will not buy machinery unless it is just what they think they require. Another absolute necessity is that weights and measures must be given in the metric system, and prices quoted should be landed at Belgrade; and still another important factor is prompt shipment.

Here is a sample of how a Belgium manufacturer secures trade. Some time ago he sent an artillery officer to Mexico, where he remained for some time. From that country he proceeded to Brazil, and he intends to travel through the other republics in turn; with him he has a light field artillery of a caliber of 75 millimeters, a serviceable weapon that can be drawn by four mules; a cavalry gun of 47 millimeters, and a naval gun of 57 millimeters. These guns are taken before the naval or military authorities, exhibitions are made of them and orders are solicited. All expenses are borne by the manufacturer, and it is reasonable to suppose that it is a successful method, or it would have been discontinued long since.

The Government of the United Sates of Brazil is calling for proposals for the improvement of the port of Pernambuco, which will include the construction of a breakwater, quays, where vessels of large draft may be docked; the placing of buoys and piles for mooring vessels; the construction of warehouses; the construction of railways along the quays; the erection of a complete set of hydraulic or electric cranes. Further information of this work can be obtained in Washington, and sealed proposals may be sent to the Brazilian Legation in that city not later than February 28, 1898; these proposals will be opened at a date to be named hereafter.

There is a need in Paraguay for machinery to be used in the extraction of cocoa oil. Good hand machines should be constructed to crack the shell without damaging the kernel, and with a capacity of about 50 pounds per hour. At least 90 per cent. of the kernels turned out should be whole. The machine should be as simple as possible in construction, and should be of strong material, and should sell for a sum not to exceed $50. A certain number of these machines would find ready sale.

There is and will be from this time a large and growing need for agricultural machinery, such as threshing machines and the like, in Chili, due to the fact that the cereal crops are far in excess of what they were in former years.

An enterprising firm of Erie, Pa., found a ready sale in Mexico last year for boilers and engines; there is plenty of room for enterprising American manufacturers of all classes of machinery in Mexico, from the largest to the smallest. The trade will have to be fought for, however, for European and English manufacturers are right after this trade.

A. F. TENNILLE.

Washington, D. C.

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American Tools in England.

Some decidedly plain talk is being indulged in by English engineers anent the invasion of English and neutral markets by American tool builders. A short while ago one who signed himself "A Machine Tool Maker" had a letter in "Engineering," the character of which letter may be inferred from the answers to it from which we extract as follows:

"* * * Now, about 'the traveler from the States or the Continent' who comes 'round and 'is received with open arms.' That is often a fact, perhaps, to some extent, because one feels a call made on the national character for hospitality when a foreign representative calls. Beyond this, however, the foreign traveler is, I may say, always a courteous gentleman, with a thorough knowledge of his business. No doubt the best examples are sent to this country, as we possibly always send good men abroad. I believe it is a recognized fact that the 'foreign traveler' of an English firm is a man of high attainments. To send abroad involves a large expenditure, and that alone is sufficient reason. I am, however, getting away from my main issue on side points. What I was about to say is this: The 'traveler from the States' offers machine tools of a class such as are not produced in Great Britain. What the cause for this may be I need not stop to

inquire; it may be the fault of the trades unions who bar labor-saving tools, or it may be the fault of the masters who have not the ability, or are too much occupied with other things, to push their business in this direction. As an instance I will take an industry with which I have no connection, the bicycle trade. At the present time thousands and thousands of pounds are going to America for automatic tools to make bicycles. This is not because bicycle makers hate their own countrymen, but because they positively cannot get these ingenious and beautifully made machines at home. The American makers are so overstocked with orders that they have to keep their customers waiting—in fact, the cycle trade is positively crying aloud for machinery—makers are in despair because they cannot get it for their spring order work, and yet England cannot fill the gap—no, not even Manchester! Yet the cycle had its origin in England, and was a large industry here years before it was much more than thought of in America.

"I have only taken one branch of industry, but others could be instanced. I heard of a case the other day in which a large engineering firm wanted several machines made for repetition work. One celebrated English firm was requested to take the matter up, but beyond suggesting the purchase of additional machines of ordinary types, they were unable—or declined—to do anything. A German traveler came along—he had been calling for years without getting encouragement—and, hearing of the chance, at once offered to go into the matter thoroughly, and subsequently sent in a tender for a set of special machines for the work, these machines being guaranteed to produce a certain minimum output at a definite maximum cost. The machines were ordered, and in due time were delivered and more than satisfied their guarantee. Need I say that the makers have had further orders?"

This letter is signed "A Machine Tool User"; the extract below is from one signed "A Tool Buyer":

"The fact is that the average machine-tool maker is a kind of Rip Van Winkle. He has been asleep for twenty years, and it is only recently that he has been roused. Even now he is not fully awake, and he finds the bustle of the modern world very annoying. He would like to hush it into a state of repose more congenial to his feelings, and so he sends to the papers some recollections of the past, calling them 'Suggestions for the Future.' It is a future which will never be realized.

"The special cause of his discontent is the success of the American machine-tool maker over here, which he ascribes to every reason but the true one. Specially wroth is he with the kind reception that the Yankee gets at the various works he visits, while the English traveler has the cold shoulder. I will tell him the reason. The American is a mechanic, and a very smart one, too. He thoroughly understands his business, and has plenary powers to conclude a bargain. He can pick up a piece of work and say, 'I will guarantee to make you a machine to turn out these at so much a dozen, and the price will be so much.' The Englishman says, 'I will make a note of your requirements, and our firm will write you on the subject.' What is the use of taking a commercial traveler into your works? You can get no ideas out of him, and the ideas you put into him get sadly changed before they reach his principal. We don't take strange Americans into our confidence because we love them, but for the sake of what we can get out of them; and we don't pay them more than we can help."

There is instruction as well as amusement in the above. Something of what to avoid and what not to avoid is shown by these letters.

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American Competition.

Mr. Yarrow, of Yarrow & Co., a leading engineering firm in Poplar, London cables to "The Times" of London from Boston that the result of his tour of New England has impressed him with the fact that a most severe competition is inevitable from the United States.

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As a result of an appeal to a higher court, the award of damages to the amount of $21,000 in favor of Fred R. Ketcham, for being blacklisted by the Chicago & Northwestern Railway, has been set aside and a new trial granted.

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Commercial Review.

NEW YORK, Saturday Evening, Jan. 15, 1898.

MACHINISTS' SUPPLIES.

The situation in these varied lines, taken generally, is satisfactory. The time of quietude, incident to the principal account-taking period of the year, and which is supposed to continue until about the end of this month, is not yet over, but already, in many quarters, it has been broken, with orders reported as coming in nicely, and we think that, on the average, business has been fully up to what might be expected for the first half of January.

There is in the market an obvious undertone of returning confidence. People entertain bright expectations of a steady improvement in trade. Dealers look back upon 1897 and see that it was 20 or 30 per cent. ahead of 1896, and they anticipate a continuation of the good work. Where everybody is looking for prosperous times they are very apt to come.

The tendency of prices, in the main, is healthy. The advance of wood screws and of the larger sizes of cut machine screws at the first of this month was one of the most recent increases. That, indeed, was trifling. Prices are steady rather than on the move, but their tendency is upward. It is even thought that twist drills will display firmness before long. Wrought iron pipe is weak, but that should hardly be classed with machinists' supplies.

MINING SUPPLIES FOR ALASKA.

A house in this city which handles a miscellaneous assortment of machinery and sundries is doing a flourishing trade with parties fitting out for the Klondike. They have already equipped half a dozen such expeditions. We had supposed from some of the stories which come from Dawson City that the departure of new expeditions must now be rather checked; yet the firm of which we speak say that this business is now at its hight. They are at present figuring upon two such deals, one of them amounting to $8,000. Some of the parties starting out are incorporated companies with a paid-up capital of $25,000 or so. They buy a great variety of supplies—engines, boilers, sawmills, dredges, hydraulic apparatus and sundries.

The Fraser & Chalmers Company, of Chicago, has just closed a contract with Captain Thomas Main, of the Alaska Treadwell mines, for $400,000 worth of mining machinery, including 520 stamps, besides engines, compressors and other apparatus.

POWER TRANSMITTING MACHINERY.

The particular status of this line of supplies may be given by stating the experiences of three leading companies in the New York market. One of them reports a pretty good demand, much ahead of that a year ago. They say that the holiday period, as usual, caused a flurry in small orders, owing to the fact that manufacturers avail themselves of the resting spell for making repairs. Another concern reports business as noticeably improving, and that they have received some half a dozen contracts for complete equipments within ten or twelve days past. They find that supplies for holiday installation have to be ordered some time beforehand in order to be gotten ready, so that there is no particular flurry just at the end of the year. Another large concern, whose main offices are in another city, confines its attention here principally to estimating on large contracts. Of such there are quite a number in contemplation, though people are somewhat dilatory in closing them up. It is com-

mented upon as a special feature of power-transmitting machinery that there are so many equipments of silk and other textile mills being put in. This is partly because the Dingley tariff has rendered it necessary that manufacturing which formerly was done in Germany be transferred to America.

MORE OPINIONS FROM THE ENGINE BUILDERS.

In continuation of the views upon the engine market published in our last issue, we print the following, which came to hand too late for insertion then.

From the Buffalo Forge Company, Buffalo, N. Y.:

"The number of sales of steam engines in the past year has exceeded any previous one. Our engine department has been behind with orders, and has had to work overtime a good deal. At the present writing we are running full time. In addition to our regular Horizontal Electric Light Engine, we build a number of special types, both single and double, for use on shipboard."

From the Heilman Machine Works, Evansville, Ind:

"Business is better than it was twelve months ago. The year just ending was a fairly good one for our machinery and thresher trade, and during the last half of the year we have added the manufacture of Corliss engines to our line. We are putting our works in condition to build all sizes of our latest improved heavy duty Heilman Corliss engines, and are now putting in heavy tools that will enable us to compete with any builders in the country. Inquiries are coming in steadily, and we expect a good trade the coming year."

They tell us of several Corliss engines built or building by them, one being for their own shop, besides an order just received from the Midland Steel Company for one of 34x60 inch cylinder.

Two leading high speed engine companies of New York State have been interview by a representative of the "American Machinist," one reporting business as fair, the other as indifferent. The old line of plain slide valve engines is said to be flat.

ODDS AND ENDS OF TRADE.

With the intention of competing with American electrical companies in the markets of Central and South America, the "German Transoceanic Electrical Company" has this month been formed in Berlin. It is said that they will erect a central station at Buenos Ayres in March.

We understand that the business of the Sessions Foundry Company, Bristol, Conn., for the past year has been the largest in its history, and from present indications will be considerably larger in 1898.

The Brooks Locomotive Works is shipping ninety-two carloads of locomotives to the Far East. Four of these engines are destined for Corea, and are the first ever sent there from this country.

The United States Consul at Amoy writes that the sale of American manufactures in China is often crippled by their being painted in unlucky colors; while, on the other hand, the goods are sometimes bought for the sake of getting a lucky label. Perhaps our tool-makers might here find a hint. Let them bribe some laundry-man to reveal the lucky color combinations, and then build their lathes painted, say, with a yellow frame, sky-blue bed, lavender carriage and vermilion gears; a gilded name-plate, for the sake of getting which the lathe will be purchased; a prayer-wheel on the spindle and a tailstock in the form of a little idol, to which the machinist can make his devotions while he is doing his work—if all of which conditions be complied with there should be a boom in the Chinese machine tool trade. Yet we fear this to be a hopeless ideal, for the con-

Continued on page 38.

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

First-class vise hand wants pos'n. Box 29, AM. MACH.

Dftn., asst. book-kr. & forns. asst. Box 24, AM. MACH.

Chief engineer, who is also a machinist, wishes to take charge of large plant. Box 35, AM. MACHINIST.

Mech. draftsman and mchst.; exper. steam, marine pump, gen. mach.; desires position. Box 18, AM. MACH.

Wanted—Situation as foreman patternmaker; 20 yrs. exp.; 5 years foreman; best of ref. Box 30, AM. MACH.

First-class draftsman and mechl. engineer; 20 years' varied exp.; designer of high-grade eng., etc.; open for eng. Address Box 10, Painted Post, N. Y.

Practical machinist and tool-maker wants change; used to gigs, fixtures, screw mach. tools; at present has charge; good references. Box 34, AM. MACHINIST.

Capable young machinist wants further instruction in one branch of trade in first-class shop; 6 years' shop exp.; A1 refs.; investigate. Box 28, AM. MACH.

Wanted—Position by machinist; foreman of extensive experience; a hustler and up to date in modern methods and tools. Address Box 26, AM. MACHINIST.

Expert mech. draftsman, competent young man, wants position in eng. capacity; salary secondary consideration; first-class ref. Address Box 22, AM. MACH.

Situation wanted as foreman, master mechanic or any capacity requiring the services of a first-class mechanic; exp. in marine and stationary work; vicinity of New York preferred. Box 32, AM. MACHINIST.

First-class mach. desires steady position in mill, factory, on exp'l work or assembling complicated mach.; age 30; strictly sober habits; faithful, energetic and conscientious worker with wide exp. Box 25, AM. MACH.

Situation wanted as factory manager or supt. by practical inventive machinist; 20 years' experience supervising manufacturing; very successful in past; best of references from last employers and others. Box 5, AMERICAN MACHINIST.

A thoroughly practical mechanic with extensive exp. in the handling of foundries, mach. shops, etc.; in electrical, eng., power transmitting mach. and various other lines desires a position as supt. or manager; salary or share. Address Box 33, AMERICAN MACHINIST.

As supt. or m. e.; a thorough technical education and 12 years practical exp. on general mach. work, heavy mach., tools, automatic mach., high grade special mach., drop forge, punch press, die and jig work; at present mech. eng. for one of the largest mfrs. in New England. Box 23, AMERICAN MACHINIST.

Engineer, 32, thorough tech. education; member A. S. M. E.; splendid experience as constructing eng. and manager, desires change; knows modern methods of mach. designing and shop practice; immense exp. on construction Corliss and other engs., air compressors, ice mach. and the most improved gas eng. practice; competent to assume charge of works of any magnitude; pos. as gen. supt. or chief eng. wanted; highest testimols. from all past employers. Box 20, AM. MACH.

Help Wanted.

Wanted—Man to install high speed engines direct connected to dynamos. Address Box 3, AM. MACH.

Wanted—Foreman, thoroughly exp. with mach. tool line lathes, planers, boring mills, radial drills. Address the Davis & Egan Machine Tool Co., Cincinnati, O.

Gun and locksmith and bicycle repair man wanted in a Montana city; must be a first-class mechanic and thoroughly experienced; give age, experience, references and wages wanted. Address Box 9, AM. MACH.

Wanted—Foreman for a small factory of light machinery; must be young and intelligent, and capable of handling help and getting work out quickly. Previous position as foreman not necessary. Foreman, Carrier No. 117, Buffalo, N. Y.

Wanted—An expert workman on mathematical instruments, assay balances or microscopes; must understand all kinds of brass finishing, and mixing and applying lacquer; first-class men only need apply; answer stating exp. and by whom last employed; also wages expected; factory out West. Box 31, AM. MACH.

Mechanical Draftsman Wanted—The advertiser has a small general machine works located in this city, and requires a competent and experienced man to take charge of same in the early future. Applications to be noticed must state age, nationality, experiences, with satisfactory references, which will be treated strictly confidential; to a satisfactory party an interest would be possible. Address Box 27, AM. MACH.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Job lot radiators, 12"1-2c. ft., S. M. York, Cleveland, O.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

I make dies; send sample and see what they cost, J. L. Lucas, Providence, R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

WOSSIDLO & CO.,
MERCHANTS AND ENGINEERS,
St. Petersburg and Moscow,
Represented in all important towns of Russia, **Contractors to the Imperial Russian Navy, Artillery, Railroad and Mining Departments,** &c., are open to **enter into correspondence** with **first-class American firms,** with a view to representing them in Russia and request them to send price lists of machinery and of all recent technical inventions.

PRACTICAL SCIENTIFIC ELECTRICAL BOOKS
CATALOGUE FREE.
PHILADELPHIA BOOK CO.,
15 S. NINTH STREET, PHILADELPHIA, PA.

IRON WORKING MACHINERY
AND ALL KINDS OF
MACHINE SHOP SUPPLIES.
COLCORD & SANDERSON,
502 N. Second Street, St. Louis, Mo.

Continued from page 37.

sul proceeds to say that no information or description can enable the engraver or colorer to produce effects which will not be recognized as the work of a "foreign devil."

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Quotations.

NEW YORK, Monday, January 17.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $12 25
No. 2 foundry, Northern	11 75 @ 12 00
No. 2 plain, Northern	11 50 @ 11 75
Gray forge, Northern	10 75 @ 11 00
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry Forge, Southern	9 75 @ 10 00

Pig iron prices show no advance, but we have adjusted the prices on Northern pig to what are quoted as the proper ones by a leading firm. Concessions may be made by some dealers.

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2.20 @ 2.30c.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10⅞c.; casting copper, 10¼c.

Pig Lead—Carload lots, 3.65 @ 3.70c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.90c., f. o. b.

Spelter—Carload lots, 3.90 @ 4.00c. for good brands, New York delivery.

Antimony—Cookson's, 7¼c., higher rates on small lots; French, E. B., ruling about ¼c. less; Hallett's, 7.40 @ 7.50c.; Japanese, 7⅜c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 40 @ 42c.

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Manufacturers.

Healy & Murray, of Fremont, Neb., are to place new machinery.

Keller's foundry, at Sauk Center, Minn., has been destroyed by fire.

The plant of the Jenney Electric Plant, at Indianapolis, Ind., is to be rebuilt.

It is expected that the town of Media, Pa., will make additions to its water system.

The Bronson-Portland Cement Company, of Bronson, Mich., is to enlarge its plant.

At Milton, Pa., the machine shop of Samuel J. Shimer & Sons has been destroyed by fire.

The machine shop of Charles Lang, on Mary street, Pittsburg, has been destroyed by fire.

The Bath (Me.) Iron Works is to have an addition made, which will be used as a joiner shop.

The Aermotor Company, of Lincoln, Neb., is to remove its plant to Omaha, in the same State.

The Crescent Manufacturing Company, of Muskegon, Mich., has decided to increase its plant.

At Newark, N. J., George Wiedenmayer is erecting a new machine shop on South Market street.

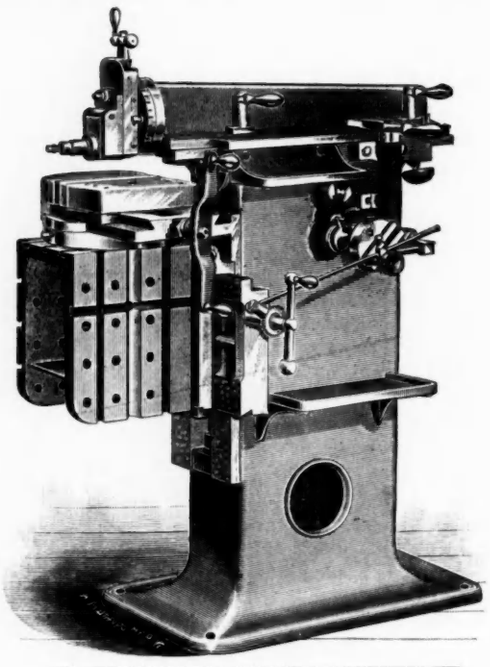
The Shenango Valley Steel Company, of New Castle, Pa., is to erect a new steel tin plate mill shortly.

The Rochester (N. Y.) Electrical Manufacturing Company has been incorporated with a capital of $50,000.

The Groton Bridge & Manufacturing Company is to build a new machine shop at Dryden, N. Y.

The Epping-Carpenter Company, manufacturer of steam pumps, is to erect a new plant at Pittsburg, Pa.

The Berlin Iron Bridge Company, of East Berlin, Conn., has a contract for a new drawbridge over the South Shrewsbury River, in



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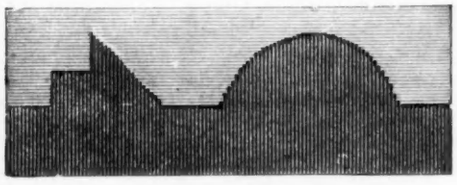
15-inch Hendey Shaper.

Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how the stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate SEND FOR CIRCULAR.

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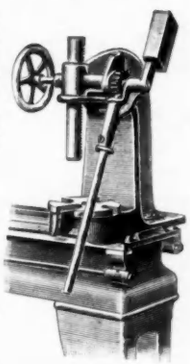

Saves marring, upsetting or springing the arbors and defacing or otherwise damaging finished work.

Saves cleaning out the centers and taking off the dogs.

Made in four sizes. Send for net prices.

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THE

WALKER COMPANY

is now building at its Cleveland works a 1,600 K. W. direct connected generator for the Union Railway Company of New York City. This, with the two now being completed for the Brooklyn Heights Railroad Company, will make three of these 1,600 K. W. machines finished in as many months.

In addition to this generator for the Union Railway Company, Walker Company is building for them 40 double No. 4 A street railway equipments. The equipments are to be fitted with the new type "S" solenoid blow-out controller which has attracted so much attention. The current for these motors will be fed to the line from a Walker switchboard, now being built at New Haven.

The Metropolitan Street Railway of Kansas City, which is now operated by a 1,600 K. W. Walker generator, is about to increase its plant by the addition of a generator of 1,200 K. W. capacity, and as a contrast to these immense machines it may be mentioned that the Company is building a 25 K W. lighting generator for Mr. J. J. Astor's new yacht.

The foreign shipments during the next few months will include 100 double 3 S street railway equipments, with 200 controllers, for Dresden, Germany; six double No. 3 N equipments with type "S" controllers, and two double No. 3 N equipments.

Besides these railway motors and accessories there will be one 150 K. W. belted railway generator with its switchboard, and a 75 K. W. belted booster for Japan, also with a switchboard.

This makes over 7,500 horse power in street railway motors alone that are being built at the Cleveland works, to say nothing of the horse power output in generators.

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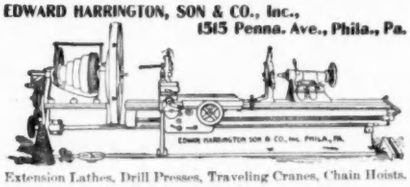

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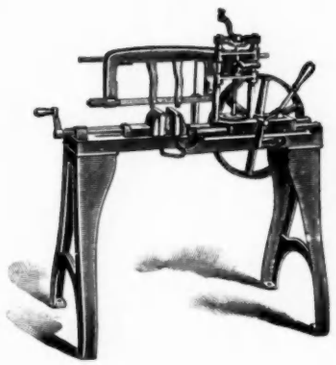
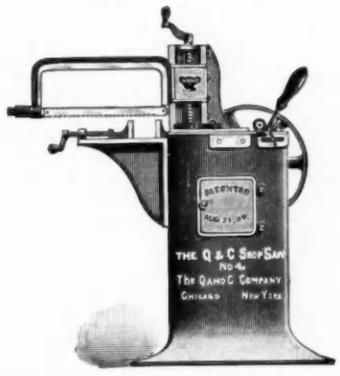


Special Machinery For Cutting All Kinds of Iron and Steel Cold. . . . . .



The Q & C Co.,

700-709 Western Union Bldg., CHICAGO, ILL.

100 Broadway, NEW YORK, N. Y

537 Mission Street, SAN FRANCISCO, CAL

Monmouth County, N. J. This bridge is to be 180 feet in length and 40 feet wide.

The Story Electric Company, of Chicago, has been incorporated. The incorporators are W. H. Utt, G. W. Oberlander and Eric Winters.

The Driggs-Seabury Gun & Ammunition Company, Bridgeport, Conn., has decided to build another addition, to be used as a foundry.

Wolf & Co., of Chambersburg, Pa., have purchased about 40 acres of land and will erect a plant for the manufacture of flour machinery.

The American Stoker Company has removed its offices from Dayton, Ohio, to Rooms 72, 73 and 74 Garfield Building, Brooklyn, N. Y.

F. H. Palmer, of New York, has been negotiating for the purchase of the Van Sickle farm at New Brunswick, N. J., on which to enlarge a factory.

The Morse Chain Company, of Trumansburg, N. Y., has been incorporated. The directors are E. F. Morse, F. L. Morse, E. T. Turner and H. H. Westinghouse.

It is expected that the Florence Wagon Company, of Florence, Ala., which went into the hands of a receiver some years ago is to be reorganized.

At Niagara Falls, N. Y., the Niagara Falls Acetylene Machine Company has been incorporated to manufacture machinery used in the manufacture of acetylene gas.

The Clark Paper & Manufacturing Company, of Rochester, N. Y., has recently been incorporated. The directors are F. W. Clark, Geo. A. Benton and Harvey B. Clark.

Fraser & Chalmers, of Chicago, will soon commence the construction of an addition to their plant. This addition will include a machine shop, toolhouse and blacksmith shop.

The Garland Milling Company, of Greensburg, Ind., has been incorporated. The directors are R. P. Moore and G. B. Moore, of Princeton, and G. B. Ayres, of Greensburg.

It is reported that C. W. Bleecker, of the East Orange Coal & Ice Company, East Orange, N. J., is interested in a new ice manufacturing plant to be erected at Orange, N. J.

The Leversee & Snyder Manufacturing Company, of Cohoes, N. Y., has been incorporated to manufacture paper boxes. Capital $12,000. J. D. Leversee and W. W. Snyder are among the directors.

The R. G. Marcy Manufacturing Company, of Bluffton, Ind., has been incorporated. The directors are G. A. Ullman, of Ashland, Ohio; R. G. Marcy, J. W. Tharick and L. H. Marcy, of Bluffton.

The Carson Electric Light Company, of Council Bluffs, Ia., has been incorporated and will soon begin the erection of a plant at Carson. William Hotze, David A. Snapp and James S. Campbell are the incorporators.

The Brass Foundry & Machine Company, of Jersey City, N. J., has been incorporated. Adolph Zimm, Wm. S. Laporte, Michael Gavin, Jr., of New York; Rudolph Gutman, of Greenville, N. J., and Francis P. McManus, of Jersey City, are interested.

The Davis & Egan Machine Tool Company, of Cincinnati, Ohio, again finds it necessary to increase its capacity, owing to its growing foreign and domestic trade. It has secured the plant formerly occupied by the Walton Iron Company, located in Covington, Ky. The building is 300 feet long by 100 feet wide, and with adjoining ground occupies an entire block. It is of modern construction, and will be equipped with electric traveling cranes, electric generators, air hoists, hot air system and all modern appliances. This new plant will simply be an addition to its Cincinnati works, and will be used for the manufacture of large lathes, planers and boring mills. It is located on the C. & O. R. R., with tracks running into it, affording excellent shipping facilities. The Davis & Egan Machine Tool Company

expects to have the new plant in operation within the next sixty days, employing a force of 300 men, giving them a total of 1,100 employés in three plants.

The National Cob Pipe Company, of Washington, Mo., contemplates the removal of its plant to Lima, Ohio.

At 127 West Thirty-second street, New York, W. S. Rogers & Co. have established a shop for the manufacture of laundry machinery.

Mr. Hampton, of San Francisco, contemplates the erection of a factory for the manufacture of oil and water tanks at San Pedro, Cal.

The Davis & Egan Machine Tool Company, of Cincinnati, has received an order for twenty brassworkers' lathes from Dowrance & Co., of London.

The Electroline Manufacturing Company, of Cleveland, Ohio, has been incorporated. J. C. Meader, John E. Day, John J. Greenway and W. C. Clark are the incorporators of the company.

The regular quarterly meeting of the directors of the Davis & Egan Machine Tool Company, of Cincinnati, Ohio, was held recently, and the officers for the past year were re-elected. A dividend of 3 per cent. was declared.

The Anderlane Manufacturing Company, of Cleveland, Ohio, has been incorporated. The company is to engage in selling and manufacturing machinery, fixtures, etc. John M. Anderson, H. J. Sherwood and Fred. H. Rice are the incorporators.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

We have received from the General Electric Company a catalog of incandescent lamps. The catalog is 8 x 10½ inches.

Charles B. King Company, of Detroit, Mich., sends us 1898 catalog of gasoline engines adapted to the propulsion of launches. The catalog is standard size, 6 x 9 inches.

The Wilkinson Mfg. Company, of Bridgeport, Pa., sends us a catalog illustrating and describing its automatic and mechanical stokers. The catalog is 6½ x 9½ inches.

Joseph Dixon Crucible Company, Jersey City, N. J., sends us a catalog entitled "Hints," which describes the various uses to which graphite is put. The catalog is 3¼ x 6 inches.

Eugene Dietzgen Company, of Chicago and New York, has sent us its catalog of drawing materials and surveying instruments. The catalog contains 160 pages and is 4½ x 6 inches.

We have received from Morse, Williams & Co., Philadelphia, Pa., a catalog of electric elevator engines, adapted to both freight and passenger elevators. The catalog is 3½x6¼ inches.

Hilles & Jones Company, of Wilmington, Del., sends us catalog O of machine tools, including punches, shears, rolls, plate planing, vertical milling machines, &c. The catalog is standard size, 9x12 inches.

Jones & Lamson Machine Company, of Springfield, Vt., has sent us 1898 catalog devoted to the illustration and description of the Hartness Automatic die. The catalog is standard size, 6x9 inches.

We have received from the Brown & Sharpe Manufacturing Company, Providence, R. I., 1898 catalog and price list of machinery, tools and castings. Their product covers a large variety of tools. The catalog contains 437 pages and is divided into two sections, one devoted to machine tools and the other to small tools. The catalog is 3½x5¾ inches and will be sent to all interested upon application.

GANG DRILLS

of improved design, with two, three, four and six spindles in four sizes. The spindles are made of tool steel, have steel boxes hardened and ground, with provision for adjustment for wear. Tables are counterbalanced.

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Send English catalogues to German waste baskets. Send literal translations and supply laughing matter for the noon hour. Send German catalogues in correct shop German and bag orders. If you don't know how to write them, I do.

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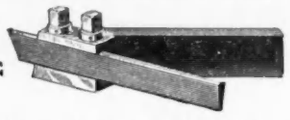

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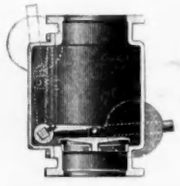

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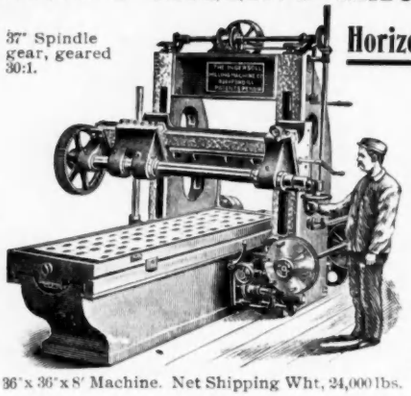

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Power elevating and lowering device.
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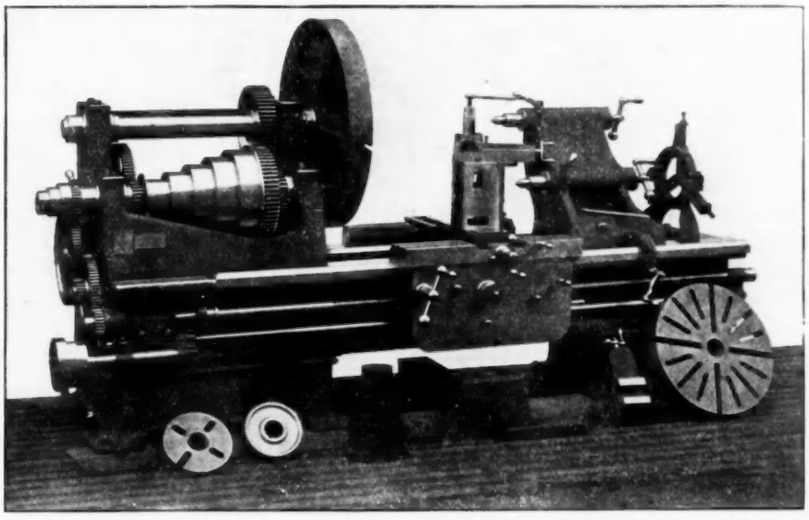

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is actually Two Lathes in One, a regular 26″ and Triple-Geared 44″, capable of turning out work rapidly and accurately, from the smallest class up to 44″. Solid in construction—wide range of speeds and feeds—changed in a moment for any kind of ordinary work. Costs but little more than a regular 26″.

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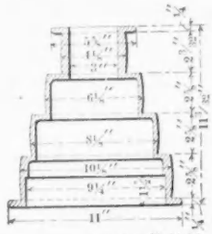

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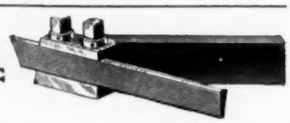

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Lathes, from 12" to 48"; Planers, from 20" up to 60" 48", 54" and 60" Radial Drills; No. 2 Newton Milling Machine; No. 2 Screw Machine; Shapers, from 6" to 30" Boilermakers' Punches, Shears, Edge Planers, Rolls, Drills, Engines, Boilers, Pumps, and Dynamos.

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FINE LOT SECOND-HAND MACHINERY.

We have just bought two entire plants, which are fully equipped with modern machinery comprising the following:

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45-56 in. x 15 ft. Pond, C. R. & P. C. F., has 4 chuck jaws fitted.
32 in. x 14 ft. Pond, C. R. & P. C. F.
38 in. x 17 ft. Wood & Light (very heavy).
25 in. x 12 ft. Harrington, C. R. and P. C. F.
24 in. x 8 ft. Blaisdell, P. G. & P. C. F.
20 in. x 10 ft. Lodge & Davis, 1 1-2 in. H. S. C. R. & P. C. F. and taper.
20 in. x 10 ft. Perkins, 1 in. H. S., P. G. & P. C. F. & 20 in. 4 jaw chuck fitted.
17 in. x 6 ft. Putnam, 1 1-2 in. H. S., C. R. & P. C. F.
16 in. x 8 ft. Pratt & Whitney P. G.
15 in. x 6 ft. Porter, with grinding attachment.
3 14 in. x 6 ft. Lodge & Davis, 1 in. H. S., P. G. & P. C. F., 3 chucks.
14 in. Putnam Stud Lathe.
13 in. x 5 ft. Ames, 3-4 in. H. S., R. & F. rest and 2 chucks.

PLANERS.

42 in. x 42 in. x 16 ft. Bement, 1 head.
36 in. x 36 in. x 10 ft. New Haven, 2 heads.
24 in. x 24 in. x 8 ft. Pratt & Whitney, 1 head.
24 in. x 20 in. x 5 ft. Hewes & Phillips, worm drive.
18 x 16 in. x 3 1-2 ft. New Haven.
16 in. x 16 in. x 3 ft. Putnam.

SHAPERS.

24 in. Hendey Friction.
16 in. Hendey Friction.
13 in. Betts Traveling Head Ck.

DRILLS.

40 in. New Haven, P. F. & B. Gears.
32 in. Pratt & Whitney, B. F. & B. Gears.
No. 1 2-Spindle Garvin Gang.
No. 2 3-Spindle Garvin Gang.

MILLING MACHINES.

No. 15 Brainard Universal Tool Room, complete; has vertical milling attachment.
No. 3 Brainard Stand. Univ., with lot of extra tools.
No. 1 Cincinnati Tool Room, with all attachments.
No. 1 Brown & Sharpe Universal Tool Room, with all attachments, and lot cutters.
2 No. 2 Garvin plain, with at.
No. 3 Garvin Hand, with attach.

SCREW MACHINES.

No. 3 Pratt & Whitney, with wire feed and lot of collets and turret tools.
No. 2 1-2 Garvin, with wire feed, pump, full set turret tools and spring chucks.
No. 2 Pratt & Whitney, wire feed, with all attachments.
No. 1 Prentiss, wire feed and all attachments.
No. 1 Pratt & Whitney, wire feed and all attachments.

GRINDERS.

Cincinnati Uni. Tool & Reamer.
No. 6 Diamond, with surface at.
No. 4 Challenge, complete.
No. 2 Challenge, complete.
Style "C" Worcester twist drill.

PRESSES & HAMMERS.

60 ton Watson & Stillman Hyd. Press, with pressure gage.
1 ea. 10 and 15 ton W. & S. Hyd. Jacks.
No. 5 Eaton Power Press, complete.
No. 2 Waterbury Power Press, complete.
We also have in stock 20 friction drop hammers, all sizes, 160 to 1,000 lbs. Full particulars on application.

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1-Spindle Garvin Profiler (latest pattern).
2-Spindle Ames Profiler, complete.
2 in. Hurlburt & Rogers Cut-off Mach. Accelerated speed.
2-Spindle Whiton Cen. Mach.
Bement Hor. Boring Mach., 3 in. bar.
5 ft. Bement vertical boring and turning mill. One head.
2 Lee & Hunt Cold Saw Mach., with engines attached.
No. 1 Giant Key Seater, stroke 10 inches.
1 1-4 in. Adams Auto. Bolt Cut.
No. 1 Garvin Hand Gear Cutter, complete.
1-8 in. Adt. Rivet Machine.
5-8 in. Adt. Rotary and roll wire straightener.

Write for full particulars and prices.

PRENTISS TOOL & SUPPLY CO.,
115 Liberty Street, New York.

SECOND-HAND MACHINERY.

ENGINE LATHES.

1 14 in. x 3 ft. 6 in. Putnam.
5 14 in. x 6 ft. F. E. Reed.
1 15 in. x 6 ft. Star.
1 15 in. x 6 ft. Wood & Light.
1 16 in. x 5 ft. Ames.
1 16 in. x 7 ft. Dustin & Hubbard.
1 18 in. x 8 ft. Dustin & Hubbard.
1 21 in. x 9 ft. Pratt & Whitney.
1 24 in. x 13 ft. Lathe & Morse.
1 27 in. x 10 ft. Dustin & Hub.
1 28 in. x 12 ft. Wood & Light.
1 32 in. x 13 ft. Bement.
1 48 in. x 18 ft. G. & S.
1 Pit Lathe, 72 in. x 18 ft.

PLANERS.

2 16 x 16 in. x 4 ft. Hendey.
1 24 x 24 in. x 6 ft. Powell.
1 24 x 24 in. x 7 ft. Lathe & Morse.
1 28 x 28 in. x 8 ft. G. & S.
1 30 x 30 in. x 10 ft. Niles.
1 32 x 26 in. x 14 ft. grade, 2 hds.
1 36 x 36 in. x 12 ft. Powell, 2 heads.
1 36 x 36 in. x 18 ft., Wm. Sellers.
1 48 x 32 in. x 6 ft. Pond, 2 hds.

SHAPERS.

1 9 in. Traveling Head, Wm. Sellers.
1 13 in. Traveling Head, Bement.
1 15 in. Crank Motion, Springfield.
1 15 in. Crank Motion, Kelly.

MILLING MACHINES.

2 No. 1 Garvin Universals.
1 No. 1 Cincinnati Universal.
1 No. 15 Garvin, back geared.
1 Pratt & Whitney, Grant Patent.

DRILLS.

1 34 in. Harris Bk. G'd.
1 22 in. Prentice Bk. G. & P. F.
1 3-Spindle Hendey.
1 No. 3 4-Spindle Garvin.
1 6-Spindle Quint.
4 Suspension Drills, Pond's.

SCREW AND CHUCKING MACHINES.

1 No. 2 P. & W. Wire Feed.
1 No. 2 P. & W. Plain.
1 No. 4 Windsor Plain.
1 No. 4 Windsor Wire Feed.
1 No. 4 W. & S. Bk. G'd.
1 No. 4 W. & S. and P. F.
1 No. 2 Niles, with tools.
1 18 in. P. & W. Chucking Machine.

MISCELLANEOUS.

1 51 in. Niles B. & T. Mill, 1 head.
1 3 ft. Portable Riveter.
1 Heavy Splitting Shear.
1 Whiton Centering Machine.
1 Circular Shear.
2 Garvin Cutter Grinders.
1 No. 2 Bement Hor. B. & D. Machine.
1 No. 2 Fedrick & Ayer Cyl. Borer.
1 2 in. H. & R. Cutting-off Machine.
3 Bolt Cutters, different sizes.
1 10 in. New Haven Slotter.
1 P. & W. Double Cam Cutter.

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Putnam "Tool" Lathe, 14 inch x 6 feet, chucks, etc.
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1 Pease Planer, 24 in. x 6 ft.
1 Gray Planer, 24 in. x 7 feet.
1 Fitchburg Planer, 30 in. x 8 ft.
1 Pond Planer, 32 in. x 10 ft.
1 Pond Planer, 42 in. x 24 ft., 2 heads.
1 Gould & Eberhardt 36 in. Gear Cutter.
1 No. 4 Windsor Screw Machine.
1 Diamond Universal Grinder.
1 Brown & Sharpe No. 1 Universal Miller.
2 Diamond No. 2 Water Grinders.
1 30-in. Stevens Pulley Lathe.
1 30-in. Upright Boring Mill.
1 48-in. Upright Boring Mill.
1 63-in. Pond Upright Boring Mill.
1 14-in. Slotter.
1 Brown & Sharpe Engine Lathe, 16 in. x 8 ft.
2 Willets Engine Lathes, 17 in. x 8 ft.
1 " " " 17 in. x 14 ft.
1 Flather " " 20 in. x 10 ft.
1 Fitchburg " " 26 in. x 14 ft.
1 Pratt & Whitney Engine Lathe, 27 in. x 10 ft
1 Putnam Engine Lathe, 36 in x 12 ft.

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No. 1 Brown & Sharpe U. H. Lathe.
13 in. x 6 ft., Blaisdell.
14 in. x 6 ft., Prentice Bros.
14 in. x 6 ft., Bradford Mill Company, plain rest.
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15 in. x 8 ft., Prentice, R. & F. rest.
16 in. x 6 ft., Porter, plain rest.
16 in. x 6 ft., Putnam, comp. rest
16 in. x 6 ft., Blaisdell, R. & F. rest.
2 16 in. x 8 ft. Pratt & W., rise and fall rest.
16 in. x 8 ft., Blaisdell.
16 in. x 8 ft., Ames, comp. rest.
24 in. x 8 ft., Pond, comp. rest.
22 in. x 12 1-2 ft., Chamberlain, plain rest, 15 in. 3 jaw chuck.
50 in. Stephen Pulley Lathe.
2 Lodge & Davis Fox Lathes.

PLANERS.

Blaisdell Crank Planer.
20 in. x 20 in. x 6 ft. Pease.
24 in. x 24 in. x 8 ft. Fitchburg.

DRILL PRESSES.

2 12 in. Sens Drill, 1-spindle, Prentice.
No. 2 Pratt & W., 4-spindle.
1 Pratt & W., 1-spindle, 21 in.
1 10 in. Stover, 6-spin. tur. drill
2 3 and 4 spindle Garvin Gang Drills.
1 4-spindle Ames.
20 in. Blaisdell, W. & L. feed.
21 in. Pratt & Whitney, auto. feed, back gears.
22 in. Prentice, W. & L. feed.
24 in. Schumacher, W. feed and back gears.
1 7-spindle Adt. Drilling and Countersinking Machine.
2 22 1-2 in. Barnes, W. & L. feed, back gears, auto. feed and trip.
4-spindle Norton, auto. feed.
3-spindle Baker Drill.

MILLING MACHINES.

No. 2 Kempsmith.
No. 3 Kempsmith.
No. 1 1-2 Garvin.
No. 4 Garvin Bk. Fd. without arm.
50 in. Brainerd Keyseater.
Pratt & Whitney Circular Gear up to 36 in. diameter.

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1 21 in. x 6 ft. Flather turret lathe, back gears and auto. feed to turret.
1 21 in. x 6 ft., Lodge & Davis turret lathe, back gears and auto. feed to turret.
1 14 in. Garvin turret lathe, with pan.
1 Garvin No. 1, wire feed.
2 Garvin No. 2 1-2, wire feed.
1 No. 1 Pratt & Whitney, plain
1 No. 2 Pratt & Whitney, plain.
1 No. 2 1-2 Pratt & Whitney, 2 chucks.
1 No. 2 Windsor, w. f., chasing bar and tools.
No. 3 Brown & Sharpe.
1 No. 4 Warner & Swasey, geared fric. head, oil pump and 2 jaw chuck.
1 x 8 Jones & Lamson, plain, with 2 jaw chuck.
2 Pratt & W. Hub Machines, geared fric. head, oil pump and 2 jaw chucks.

SHAPERS.

18 in. Wood & Light, traverse.
1 12 in. crank, Juengst.
15 in. Friction, Hendey.
16 in. crank, Gould & Eberhardt.
16 in. Juengst, crank.
20 in. Friction, Juengst.
24 in. Friction, Hendey.

MISCELLANEOUS.

2 H. P. Nash Gas Engine, with sound deadener, gas bags, etc.; 1 No. 2 Garvin Auto. Tapper; 1 Garvin Boring Mill; 1 40 in. Boring and Turning Mill, 1 Head, new; 1 Amer. Gas Furnace; 1 Dienelt & Eisenhardt Hammer; 1 10 in. New Haven Slotter; 1 28 x 16 x 52 in. Springfield Surface Grinder; 1 Cincinnati Cutter Grinder; 1 Garvin 1-Spindle Profiler; 1 No. 3 Garvin Cut. Grinder.

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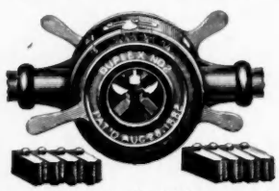

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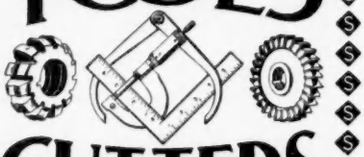

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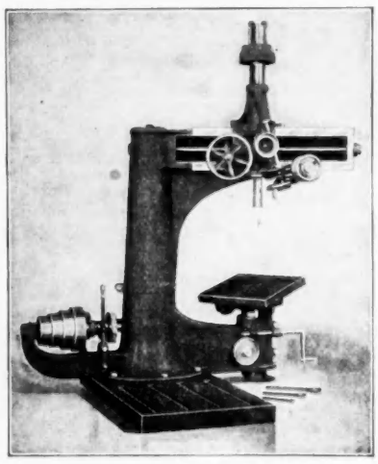

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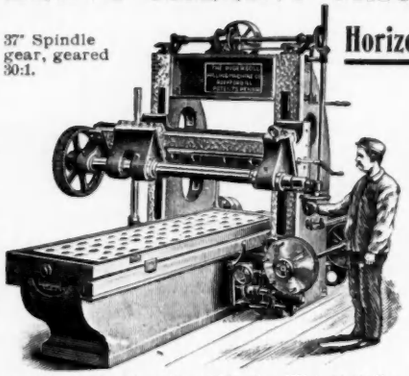

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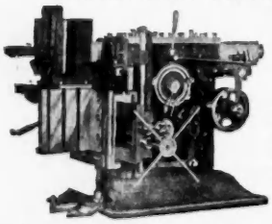

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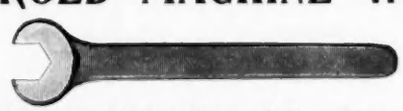

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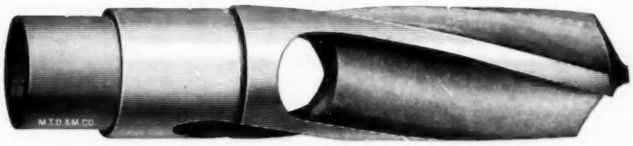

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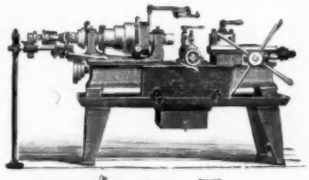

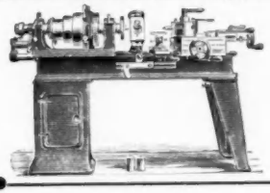

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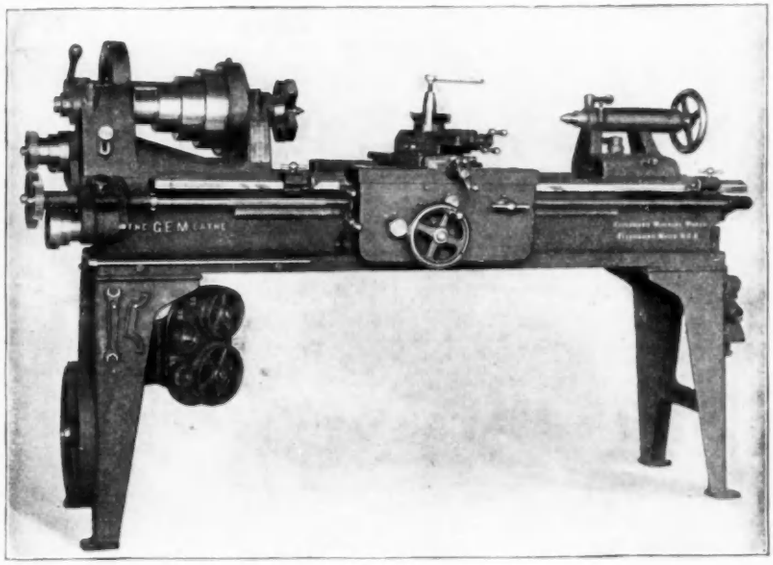

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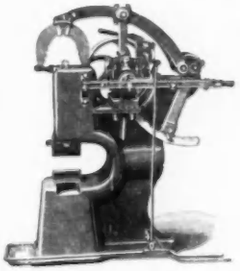

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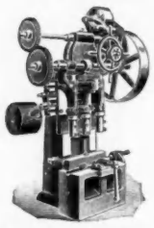

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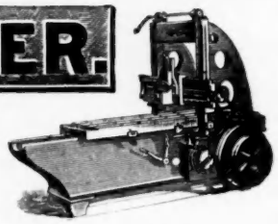

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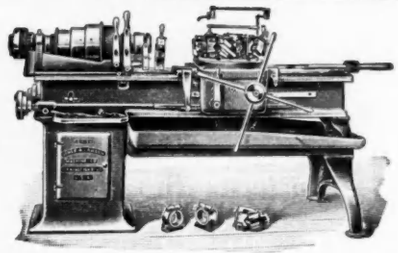

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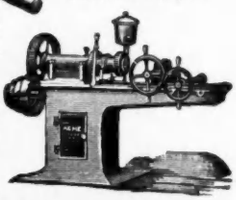

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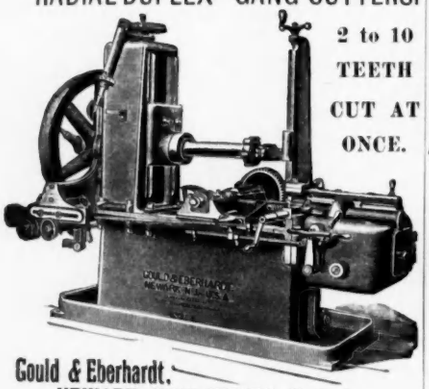

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